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CHICAGO, AUGUST 1912.

TABLE OF CONTENTS.

Editorial	57-60
Prize Contest Postponed	57
Independent Telephony	57-58
California Decision on Competition	58-59
"Telegram"	59
"A Lot of Loaded Lines"	60
Poles of Reinforced Concrete. By F. C. Perkins	61-62
What One Woman Thinks. By Sarah Elizabeth Brown	63-65
New Type of Long Distance	65
Some Applications from Would-Be Operators	66
Vibrations of Diaphragms. By Meyer and Whitehead	67-71
Steel Channels for Cross Arms	72-73
Wabash Adopts Telephone for Dispatching	74
The Telephone Scrap Book	75-79
German Police Pocket Telephones	80
Telephone Statistics of the World	81-83
Digest of Foreign Literature	84-87
The Mission Telephone	87
Standard Methods of Dry Cell Testing	88-90
Who's Who in the Telephone Game	91-92
The Saw and the Telephone. By E. J. Wenner	92-94
Department of Railroad Telephones	95-96
The Railophone—A Safety System	97-98
Of Interest to the Trade	99-103
Brevities of the Business	104-106

PRIZE CONTEST DECISION POSTPONED.

WE WERE confident, when we inaugurated the prize contest for articles on long distance telephony, that we had started something. We even guessed that the number of contributions might exceed those in our former contest on telephone courtesy. But we were quite unprepared for the great volume of manuscript that poured in upon us—most of it in the last few days of the contest.

For this and other reasons the board of judges has not found it possible to reach a final decision in time for publication in this issue of TELEPHONE ENGINEER. We realize that this works something of a hardship on the contestants, who must be in a state of suspense. This we regret exceedingly, but cannot see how it is to be helped; unless, indeed, we should turn the affair into a lottery, in definance of Uncle Sam, and draw four at random from the pile—which proceeding would not be calculated to go far toward solving the problem of long distance.

The thirty-day respite will give a much better opportunity for the profound consideration and studious meditation to which the subject is entitled, and will, no doubt, result in a division of spoils whose equity will be unquestioned. The names of the prize winners, the judges, and the first prize article itself will, therefore, be published in the September issue.

INDEPENDENT TELEPHONY.

INDEPENDENT telephony used to be a word to conjure with. It signified the greatest aggregation of public utilties in the world. Its followers were the most loyal band ever gathered under an industrial banner. Its betrayers were made to suffer such ignomy as only the devotees of a passionate cause could inflict. The countries of the world have never claimed, in the name of patriotism, a higher devotion than had this strange child of sordid commerce.

The evolution of industrial conditions has brought no tangible reason for a change of heart. Yet today the independent operator is regarded as a good business man who, but ten years ago, would have been branded a traitor to the cause. The "old-school" independent is getting scarce. There are a few of him left; but his fellow operators seem more prone to smile indulgently at his declarations of faith than to acknowledge themselves fired with the old spirit.

Why?

The typical Bell operator of today is no whit different from his former self. He pooh-poohs at the independents in the same old way, neither more nor less. Yet are not the independents taking him more

seriously today, even agreeing with him on points that formerly aroused their righteous wrath?

The Bell operator believes in his anti-independent arguments; but then, he always did. The independents are beginning to believe them too—and they never did before. Both agree—the one gloatingly, the other grudgingly—that independent telephony, the old, simon-pure variety, is practically a thing of the past.

Yet the interested, impartial observer knows that the independent telephone today is as strong as it ever was; that if the independents would, they could hold the telephone situation of the country in the hollow of their hands.

Independent telephony is less than twenty years old. That is much less than a human generation; but those "industrial patriots" who signed the telephone declaration of independence, back in 1894, were not all young men, and no doubt their original fire has cooled through long years of struggle. It is the old story, affecting an industry instead of an individual. The father spends his life fighting for principles that he can hand down to his son unsullied; and the son takes them over and proceeds to make terms with the enemy.

If independent telephony is languishing, it is because it has not got the men behind it that it once had—because it is in the hands of operators who view with too great alarm those modern features of commission regulation and public intrusion generally that mark the end of "sentiment."

Independent telephony used sentiment as its most efficient weapon. Sentiment got capital, got subscribers, and raised enthusiasm to the fighting point. But it is a mistake to say that independent telephony was founded on sentiment.

The independents got much business with the most fundamental of competitive weapons—lower prices; but their success was not limited by those prices.

A truly independent operator is one who gives the best possible service at rates calculated to bring his investors a reasonable return, who buys his supplies from whomsoever he pleases, establishes his connections with a view only to good service, and holds himself accountable only to the public he serves. Such an operator need fear neither commission nor competition. If the public demands a single service, he has as good right to survival as his competitor.

The old spirit of independent telephony may be asleep; but we cannot believe it is approaching dissolution. Perhaps we can suppose it is standing somewhat aghast at the rapid developments of the last few years—the overthrow of the old dual service arguments, the invasion of the public, the evidences of inadequate rates, the defections of numerous supposedly faithful units—and simply has not yet adjusted itself to the new requirements. To say that it cannot do so, and still retain its identity, is a serious reflection on men who have long been among the leaders of the industry.

American telephony now is on a more free and equal basis than it ever was before. Those very conditions of modern operating that seem to cause alarm to the less aggressive independents should insure them equity.

Under dual service, in a large majority of cases, independent rates are the lowest. Other things being equal, the low price always gets the business. But when the rates are too low the other things cannot be equal. The laborer is worthy of his hire; the public service corporation is entitled to its proper return, and must demand it.

The public cares nothing for either name—Bell or independent. Some subscribers, no doubt, have been influenced by independent sentiment, others by Bell magnitude. But the main argument, the vital factor, is *service*. Even rates are secondary; for we must have the best.

So the whole matter simmers down to a question of management. The most efficient management produces the best service, and the best service, Bell or independent, gets the business. In the reduction to single service the best company will win.

A CALIFORNIA DECISION ON COMPETITION.

THE principle of commission regulation of public utilities tacitly contemplates the elimination of competition. Competition, in itself, is merely a regulative factor—it has no other value; and it is not right to subject a utility to two forms of regulation which cannot work in harmony. Commission regulation is accurate, scientific and economical; competitive regulation is crude, harsh and uneconomical. Where one utility adequately serves its community, there can be no reason for the invasion of a second, competing utility. Where there is already dual service, the commission can only act as umpire in the inevitable contest which will ultimately culminate in the survival of the fittest.

The only deviation from this attitude toward competition occurs where the existing utility, constituting a regulated monopoly of its field, gives inadequate service and ignores the recommendations of the commission for its improvement. In every state having public utility commissions, the law provides means for the enforcement of their rulings. When the existing utility resists that law, recourse may be had to an invitation to competition.

The California Public Utilities Commission protects the corporations under its jurisdiction from unjust competition by a "certificate of public convenience and necessity." This instrument provides that no new competing utility may enter a field until it shall have been proven that public convenience and necessity demand such competing service.

This system, designed to protect adequate service and to put the securities of public utilities upon a substantial basis, has been used as a club against the Pacific Gas and Power Company, the applicant for certificates being the Great Western Power Company. The decision of the commission in the case was unanimous and reads in part as follows:

> While the general intent of this provision of the act is plain, its application to a particular contingency is surrounded my much difficulty. It certainly is true that where a territory is served by a utility which has pioneered in the field, and is rendering efficient and cheap service and is fulfilling adequately the duty which, as a public utility, it owes to the public, and the territory is so generally served that it may be said to have reached the point of saturation as regards the particular commodity in which such utility deals, then certainly the design of the law is that the utility shall be protected within such field; but when any one of these conditions is lacking, the public convenience may often be served by allowing competition to come in.

It has been urged in this proceeding that where a utility occupying a field has generally served such field so that the advent of a second utility would merely serve to divide the business, then if the existing utility has the ability, if it choose to do so, to furnish such territory efficiently and at as reasonable rates as can be legitimately accorded by the utility desiring to enter the field, even though it had theretofore charged excessive rates or given inefficient service, yet sound economy would require the authority, which has the power to regulate the rates and service of such utility to require the existing utility to furnish such territory adequately and cheaply and to keep the second utility out.

Theoretically much can be said in favor of this contention, but to attempt to apply it would in practice defeat the very intent of the Public Utilities Act in all cases where utilities did not voluntarily accord to their patrons those things which are their due, or at least, would impose upon the public authorities the burden of forcing such utilities into a realization of what their proper relationship to the public is. In times past in this state efforts on the part of public authorities to force utilities to give reasonable rates and adequate service have been met with long continued litigation and if the public authorities have at hand an efficient and summary method of forcing public utilities to accord to their patrons such reasonable rates and adequate service, then, in our opinion, it is their duty to use it.

If any territory served by an existing utility is afflicted by such utility with excessive rates or inefficient service, and a second utility of the same kind desires to enter such territory and this commission should say to the existing utility "although when you had matters your own way, you lost sight of your duty to the public, yet we will still preserve for you this territory in consideration of your future good behavior," in how many instances does any one suppose a new utility would apply to enter a territory served by an existing utility when the only effect of all its trouble and expense would be the cheapening of the rate and the improvement of the service of the existing utility? And hence if we should in the very first important contested application for a certificate of public convenience and necessity announce the rule that where the major portion of a territory is served, though inefficiently and at high rates, the result of such application will be merely to put the existing utility upon its good behavior, then we would, in effect, be saying to all the offending utilities of this state, if there be any, "you may proceed with your present methods until competition knocks at the door of your territory and only then will you be compelled to do justice" and we would be saying to every new public utility "you will knock in vain at the door of any field now served by a utility."

The result would be that old utilities would keep their territory unspurred by the fear of competition, knowing always that only when it was imminent need they prepare to do justice to their patrons, and the new utilities, having no incentive to apply for permission to go into territory more or less completely, but inefficiently served, would limit themselves to new fields within which they would soon, in turn, assume the same attitude as would be assumed by the old utilities now doing business within the state.

Rather, do we announce the rule that only until the time of threatened competition shall the existing utility be allowed to put itself in such a position with reference to its patrons, that this commission may find that such patrons are adequately served at reasonable rates.

While there is no question as to power of the commission thus to thrust competition down the throat of an offending monopoly, and while it might be dangerous to curtail that power, there seems reason here to fear that such decisions may be too impulsively rendered. There are, in the telephone field, many points of monopolized service where the operating company displays an antagonism to regulation which might best be cured by wholesome competition. In the California case, however, we are apparently witnessing the injection of an heroic remedy where simpler ones might have sufficed, and would certainly have left the patient in a more healthy condition.

The precedent established by the California commission cannot have a very salutary effect on the other utilities in its jurisdiction. It may drive them, through fear, temporarily to improve their service; but it introduces a note of uncertainty that may have its effects upon the marketing of securities.

"TELEGRAM."

EVIDENTLY the Western Union Telegraph Company neglected an opportunity when it failed to get the protection of the United States patent office on the word "telegram." The Public Service Commission of the State of New York, second district, has not only refused to recognize the word as pertaining exclusively to the business of the Western Union, but denied the New York Telephone Company the privilege of using it at all as a call word—that is, as a substitute for a number. The order came as a result of the complaint by the Postal Telegraph and Cable Company that its rival was boldly appropriating an unequal share of the country's telegraph business by the simple process of having diverted to it all telephone calls for "Telegram."

The case affords an interesting example of the stern, fatherly discipline to which a modern public utility is subjected. No doubt in ordinary industrial or commercial circles the methods of the Western Union Company would have been applauded as good business. The proprietary interest of the Bell companies in Western Union is an open secret. What more natural than that the telephone company should seek to aid its telegraph subsidiary in every way possible—or more unnatural than that it should voluntarily divide the telegraph business that came into its hands between its own company and a rival. For the latter is the course it must pursue under the commission ruling.

The Western Union and its telephone relatives made a great deal over that word "telegram." They featured it in their advertising, called attention to the fact that no call number was necessary when the word was used, explained how simple it was to send a telegram via any Bell telephone station, and doubtless stimulated business considerably. Now the Postal is probably laughing in its sleeve because it is going to get some of that business, whether it has ever featured the word "telegram" or not.

As we said before, in private commercial circles it would have been good business to grab all the telephone telegrams, especially under the extenuating circumstances. In public service circles it is distinctly bad form.

Which only goes to show the difference between public service and private business.

AUTOMATIC OPTIONED TO TUNNEL INTERESTS.

The interests controlling the Illinois Tunnel Company, operators of the independent automatic telephone system in Chicago, have secured a five-year option on a majority of the capital stock of the Automatic Electric Company, according to the *Chicago Tribune*. As is well known, all of the equipment used by the Tunnel company is manufactured by the Automatic Electric company, also of Chicago. According to the report, the interests, under the option, may at any time during a five-year period, take more than 51 per cent of the manufacturing company's outstanding stock on the basis of $150 per share.

Should the interests avail themselves of this right,

they must also take all additional stock offered them at the same price to the amount of $4,609,200, the value of the outstanding stock.

The following is an abstract of the matter published in the *Chicago Tribune*, which has since been confirmed:

When Odgen Armour, the late E. H. Harriman, and James Stillman, the latter of the National City Bank, of New York, made the original loan of $5,500,000 to extend the tunnels of the Chicago Subway Co., they did not know much of the telephone part of the franchise. When they had increased this loan to $9,500,000 they knew more about it.

The Automatic Electric manufactures the instruments and controls the patents for the automatic telephone in the United States and Canada, and the Chicago and New York capitalists propose to make the automatic telephone in Chicago the basis for a wide exploitation of the automatic instrument. The negotiations were concluded in New York.

Now it turns out that to date the automatic telephone promises to be a bigger money earner than the tunnels, so the efforts of these capitalists will be turned towards the extension of the automatic service in Chicago and the building up of a large manufacturing company to produce the instruments used not only in Chicago but in this country as a whole and Canada.

The Armour-Harriman-Stillman interests now behind the automatic telephone have secured an option on a 51 per cent majority of the $4,609,200 stock of the Automatic Electric Co.

The option on 51 per cent of the Automatic Electric Company's stock runs for five years from July, 1912. At any time within that period the stock may be purchased at $150 per share. It was quoted yesterday at $68 per share. All stockholders are entitled to put their stock in at $150. Inasmuch as the controlling interest was held by few people, the 51 per cent was readily secured and has been trusteed with W. S. Todd, of New York.

Until the option shall be exercised, the management of the Automatic Electric Co. will remain undisturbed. The only thing which the stockholders of the Automatic Electric Co. may not do is to vote any increase in the share capital. It is predicted that long before the expiration of the option the stock will be purchased and taken over in the interest of the larger shareholders in the Chicago Utilities Co.

It develops that a spirit of aggressiveness on the part of the capitalists in the Utilities company has been created by the attitude of the Chicago Telephone Company management toward the automatic. The automatic people assert they have the better system and they are willnig to back it with all the capital necessary.

To exercise the option on the controlling interest in the Automatic Electric will mean the purchase of the entire $4,609,200 Automatic Electric Co. stock at $150 a share, which is now selling around $68 per share.

The Chicago Utilities Co. is the reorganized concern which succeeds the Chicago Subway Co. It controls not only what is known as the automatic telephone franchise, but also the tunnels and terminals.

Whisper Girl for Theaters

Charles Frohman, the American theatrical magnate, says *Popular Electricity*, has introduced an innovation at his Globe Theater in London which has proven highly pleasing to patrons. A telephone operator back of the scenes takes any messages over the telephone from outside for any member of the audience or members of the company. In the former case the messages are retransmitted over a delicate "whisper-phone" which is connected so that every seat in the lower part of the house can be reached. The girl is called a "whisper girl" because of the delicate transmitter she uses and from the fact that she must whisper her messages in order not to disturb the performance. The members of the company are whispered to through telephones connecting with the dressing rooms The first message the "whisper girl" received was from a man to his wife in the dress circle, stating that he was going to return home late.

A Lot of Loaded Lines

THOSE NEW OPERATORS.

A new central named Fannie McGuire,
Got a hurry-up call from a fire.
She grabbed the hose rack,
Shoved the spout in the jack,
And sent a stream over the wire.

Another young lady named Brown,
Put on her head-band up-side-down.
"My 9s and my 6s,"
She said, "are such mixes,
"There ain't a right number in town."

"In calling Main two-double-two,"
Said another one, "what should I do—
"Say 2—22,
"Or 22—2,
"Or tootety-tootety-two?"

We lamp by our esteemed (academically speaking) contemporary's ad pages that the Century plant at Buffalo, N. Y., is blooming again. Has it been a hundred years already?

TAKE IT AWAY. WE DON'T LIKE THAT KIND.

Sir—If the *telephone situation* (can No. 17) at Cedar Rapids, Ia., is tight, is that at Oskaloosa—or is the Belfast in Lee county?—A. L. H.

NOT KNOCKING THE OTHERS.

[From the West Bend (Wis.) *News.*]

Miss Tillie Ritger will return to act as one of our telephone girls at the central office. Hello to Tillie! Alice Becker is also employed there now, so we have some pretty hello girls.

EXTRA! ALL ABOUT BARNES.

[From the World's Greatest Telephone Trade Paper.]

BARNES, WIS.—The Barnes Telephone Company has been incorporated by George S. Barnes, Horace L. Barnes and May Barnes.

DON'T MAKE THE POOR GIRLS WORK.

[From the Allenton (Wis.) *News.*]

There are now over two hundred and sixty patrons on this line, and the manager makes a request that patrons be as brief as possible in using the telephone and to make as few calls as possible, especially to avoid unnecessary calls, as the work is too hard for the hello girls.

BOOK REVIEW.

For light summer reading, of the sort that appeals to one who reclines lazily in a hammock under the trees, anon quoting aloud the more emotional passages to the fair comrade who rests among the sofa pillows just to the left, we can recommend nothing more highly than "The Theory of Electromagnetism," by that brilliant artist, G. T. Walker.

$$u\,\mathrm{rot}\,\mathfrak{H} = \frac{u^2}{V^2}4\pi\rho - \frac{1}{V^2}u\nabla\cdot u\mathfrak{E}.$$

Also as $u[u\mathfrak{H}] = 0$,

$$u\mathfrak{E} = u\mathfrak{E}' = -u\nabla\cdot\Phi$$

Thus (37) becomes

$$-\nabla^2\Phi = 4\pi\rho - \frac{u^2}{V^2}4\pi\rho - \frac{(u\nabla)^2}{V^2}\Phi,$$

or

$$\left(\nabla^2 - \frac{(u\nabla)^2}{V^2}\right)\Phi + 4\pi\rho\left(1 - \frac{u^2}{V^2}\right) = 0 \qquad \ldots\ldots(38).$$

51. If $u = (u, 0, 0)$ and $1 - \frac{u^2}{V^2} = l^2$,

$$l^2\frac{d^2\Phi}{dx^2} + \frac{d^2\Phi}{dy^2} + \frac{d^2\Phi}{dz^2} + 4\pi\rho l^2 = 0 \qquad \ldots\ldots(39),$$

so that if we put $x = l\xi$, $y = \eta$, $z = \zeta$, we have

$$\frac{d^2\Phi}{d\xi^2} + \frac{d^2\Phi}{d\eta^2} + \frac{d^2\Phi}{d\zeta^2} + 4\pi\rho l^2 = 0,$$

and Φ is the potential at (ξ, η, ζ) due to charges represented by $\rho l^2 d\xi d\eta d\zeta$ within an element of volume $d\xi d\eta d\zeta$.

Thus at (x', y', z')

$$\Phi = \iiint\frac{\rho l\,dx\,dy\,dz}{r_1},$$

where $\qquad r_1^2 = (x' - x)^2/l^2 + (y' - y)^2 + (z' - z)^2,$

or

$$\Phi = l\Sigma\frac{e}{r_1}.$$

While it is true that the gifted author has a certain profundity of style, doubtless engendered by long association with the mysteries of India and the Far East, one soon becomes so deeply immersed in the intricate plot and counter-plot of the work that one cannot lay it down without a sense of bewilderment. It is a book calculated to bring tears to the eyes of the tender-hearted school-boy; yet it is not a tragedy. Indeed, we have seen stern, practical men burst into spontaneous laughter while perusing its pages for the first time.

It is one of those rare literary productions which, merely laid upon your library table, or desk, will increase the respect of your friends. The specimen page given here contains some of the most luminous passages. Read it to your family circle.

P. H. W.

Poles of Reinforced Concrete

By Frank C. Perkins

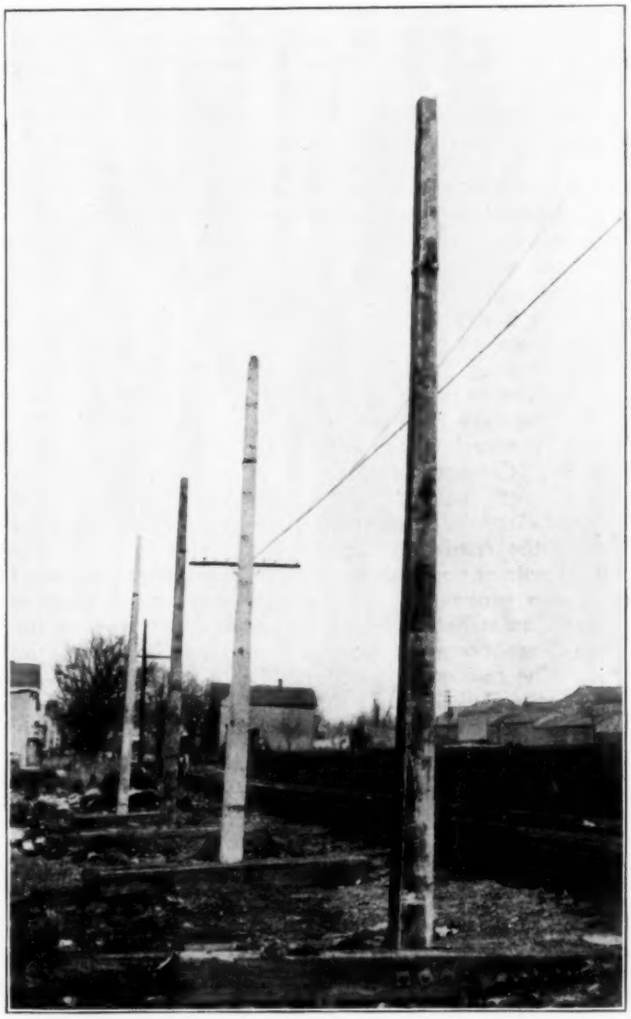
THE accompanying illustrations and drawings show the details of construction of a most interesting type of reinforced concrete pole for telephone, telegraph and electric light and power transmission lines.

There is no doubt an increasing demand for something to take the place of the ordinary familiar timber poles for electric service lines. Pole users the country over now realize that the wooden pole is practically becoming a thing of the past. It has not only been sought in the rapidly depleting forests and felled to such an extent that a scarcity exists, but with the blight in chestnut trees, the most desirable pole timber, the time is ripe for a suitable substitute.

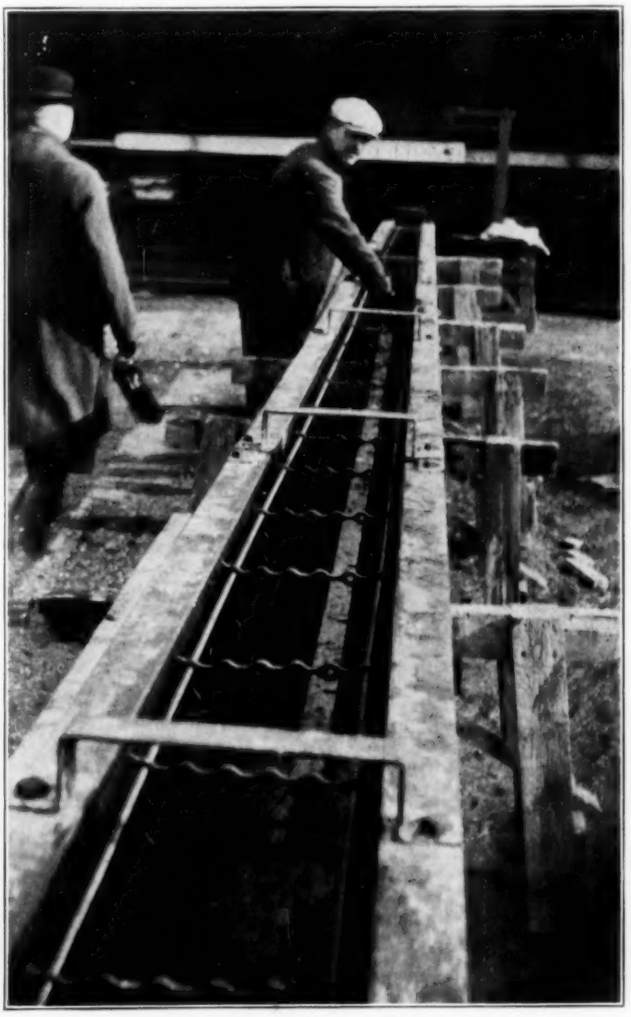
The question of permanency and elimination of pole trouble so far as it is possible is the important one in seeking a substitute and the reinforced concrete pole has been tested and brought nearer and nearer to a state of perfection.

The poles illustrated were constructed under the Rubello-Santi system with spacing rings and rigid caging of reinforcing steel. The concrete pole problem has been solved, it is claimed, to the entire satisfaction of experienced engineers, practical builders, pole users and concrete experts. Until recently the concrete pole was in the experimental stage and when built, tested and placed in practical position for use, failed to realize expectations, answer the purpose or give the satisfaction anticipated.

One trouble with concrete poles of earlier construction was that they were too heavy and cumbersome. They were imperfect in manufacture and lacked in technical construction, were faulty in reinforcement and devoid of proper strength at strain points, while numerous other objectionable conditions caused their use to be confined to a limited few instead of meeting the undoubted demand.



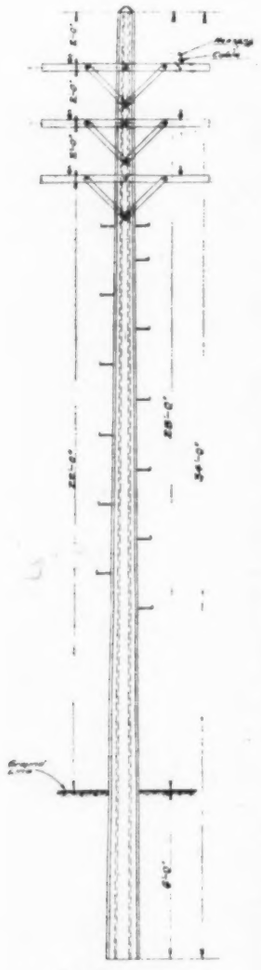
Row of Concrete Poles at Flushing, Long Island.



Preparing the Forms and Reinforcements.

It is claimed that this process makes it possible to produce a practical, commercial concrete pole entirely satisfactory for every purpose required, at a cost to the users within reason. At the same time, all things considered, it is said to be cheaper in every respect than other poles of any kind—wood, steel or cement.

These concrete poles are held to have great strength in proportion to the amount of material used, while their comparative lightness (being hollow) makes them easy to handle and transport. It is pointed out that their simplicity of construction results in a consequent saving of labor and time, with no machinery required; while they are everlasting, so that they require no maintenance and are impervious to heat, cold, fire or water, birds, insects, worms or corrosion.



Proportions of Pole.

It is held that the superior method of embedding and holding the reinforcing steel in the concrete is of great importance. In manufacturing this concrete pole after the cement has once completely set and hardened (a matter of from six to ten days according to weather conditions), great solidity and durability results and admits of the pole being handled as freely as an ordinary timber pole. It is also maintained that the resistance of the cement pole constructed under this system can be calculated in advance with exactness, based on the necessary data for its requirements, while modification in style, form or size can be arranged so as to conform in every particular to the stress of the line.

There is no doubt that permanency, or the longest life possible, is what pole users figure on in erection of a line of any kind; therefore, it is this important feature which causes the concrete pole to appeal strongly to them. The cement pole is everlasting and it dispenses with the waste of time, labor, material and service-interruption, necessary whenever a steel or timber pole has to be replaced.

There is a greater compression strength, sufficient resiliency, indestructible life with absolutely no maintenance required in a concrete pole while the oil, tar or creosote treated wooden pole has a tendency to over-resiliency with a daily loss of carrying power and resistance strength, gradual decay under weather stress and snow, rain, ice and humidity, natural climatic conditions as well as fungus growth, ravages of birds and worms, fire, lightning and vandal damage.

It is clear that the cost of the pole itself is comparatively a small item, but the expense and labor necessary to make the change, the stringing of the wires and setting the pole itself are large. It is a case of doing the same work over and over again with no view to permanency.

There is no question but that steel poles, tubular wrought iron poles and steel towers are coming into general use for power transmission lines, particularly as applied to long spans or especially tall poles; but frequent painting is necessary to prevent corrosion and this is an expensive feature. The first cost is also considerably greater than for cement poles and in conjunction with steel poles it is usually necessary that a cement or stone base be supplied as a foundation.

The chief cause of much skepticism heretofore has been the fear that such long, slender uprights of concrete would not be able to withstand the bending stresses and deflections of a pole line without cracking. Many persons bring forth the argument that constant jarring or wire sagging will wreck a concrete pole, but concrete engineers claim that this is not the case, as judging by the manner in which concrete bridges withstand the stress and strain, jar and shock they must endure and are subjected to, together with the expansion and contraction incident thereto, it is but reasonable to accord the same endurance qualifications proportionately to a properly constructed concrete pole.

That it will survive any ordinary shocks, incidental or accidental to the customary service and usages, goes without saying. Subjected to an overload or accidental shock, a timber pole may bend and yield and survive, but on the contrary it usually means a topple and fall, followed by complete havoc, requiring reconstruction and expense. Cement poles, on the other hand, do not fall or break off, notwithstanding the fact that they have far less elasticity than timber, owing to the manner of placing the reinforcement. It is possible to patch this sort of pole at very little cost or inconvenience. Repeated tests also prove that a reasonable amount of bending (more than sufficient for the balancing of stresses on the wires), can occur without any apparent injury to the pole. The resiliency is remarkable.

In the Rubello-Santi system of concrete pole construction portable sectional steel moulds with collapsible steel cores are used and the system is so simple that no skill beyond ordinary common sense is required.

Investigate Telephone Deal

At a meeting of business men, a committee of three was appointed with power to engage an attorney, and to take whatever steps are necessary to make a thorough investigation of the merits of the recent telephone merger, probable cost of service under the consolidation, and the possibility of starting a new independent company at Tacoma, Wash.

Sue Telephone Company

A suit for damages of $50,000 was filed in the United States District Court recently against the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., and Chicago. The Cracraft-Leich Electric Company of Rochester, N. Y., the complainant, charges that the Stromberg-Carlson Company infringed on one of its patents on a telephone attachment.

What One Woman Thinks

By Sarah Elizabeth Brown

WHEN I was a little girl I helped my parents with any work there was to do. They lived in the country. If I said we lived on a farm, it would hardly answer for the truth, because we were reclaiming the land from the forest. I never had any public schooling. There were a few district schools in our part of the country, but they were not convenient to our land, and I didn't go. The roads weren't good and we couldn't spare the time with the horses, anyway. There were constantly more trees to cut and more logs to burn. After a while father had a tutor come to the house and we children got our book-learning around the old fireplace. I lived at home till Obediah blew across my horizon and concluded I'd do as his running-mate in life's big handicap. Aside from Obediah's somewhat biased view, I wasn't essentially different from my sisters, or the other girls in our neighborhood. Our parents were rugged people, who built homes in the rough and comfortable fashion of the times. Field work was not disgraceful. Feeding and caring for the live stock was considered woman's work as much as it was man's work. I've chopped out more than one shock of fodder and dragged it to the racks for the cattle. There were eight girls and two boys in our family, so the girls did the chores while the boys helped clear the land. We all "made a hand," and at anything that offered. Nor was our compensation measured in dollars. We were taught that our help was required and our simple necessities were provided out of the general, though meager fund. I was eighteen when I married, which brings me up to my subject.

* * *

It is set down with good authority that there are six million women working in the United States today, and of this positively amazing number, it is estimated that less than 700,000 are skilled. I'm not so very old—a woman never gets far beyond forty, you know—but when I was a little girl, where were the girl workers? If there were any at all I never knew it. But now-a-days a girl goes job-hunting at sixteen. She doesn't stay at home and keep her parents—she goes out into the world to hunt a job. Mercy—suppose I should have had to do that! And at sixteen, if not before. I shudder. Grouped into classes, these 6,000,000 girl workers score, (1) grammer school or less; (2) high school education; (3) college girls or special training. Unskilled claims four-fifths of the total, who never reach high school. One-twentieth graduate from high school, but I've seen some terrible examples, and one one-hundredth graduate from college. Without manual training the high school graduate is little better equipped for skilled work than the girls who stop with the grammer school. You and I know about the college girl. She falls low among wage earners, because she is usually in love at the end of the first semester and married at the end of the second. And there we have it.

* * *

Six million of girls at work in the United States, mostly unskilled to start, and I dare say no greater equipment of intelligence, if as much, as the girl of my day who stayed at home with pap and mother. Six million little job-hunters have landed their jobs. They are in the maelstrom of competition, one with the other, and their wages, without the help of kind and indulgent parents, hardly sustain their bodies. Employers reap the benefit.

* * *

I give pause here, because I'm face to face with the telephone girl. I'm told the average working life of the telephone girl is less than three years—when she marries. It is one of our business compensations to know this—she marries. We have read poems and praise for the telephone girl, but there is a phase of her that has never been told. Big operating companies are always wanting more girls. Turn to the classified pages of any metropolitan newspaper and you'll find the advertisement: "We pay you while you learn." It is an appeal for switchboard operators and is based upon the full knowledge that the girls must be taught. The prevailing rule provides $5.00 a week for the term of preparation. The surroundings are ideal. There are rest rooms and lunch and easy chairs and gardens and swings and good literature. There is an hour for lunch, and rest periods during the working hours. I do not know of other industries that offer more inducement. After the applicant for place has been accepted and serves her apprenticeship on pay her wages goes to $7.00 a week—the average of clerks or saleswomen. Experience and efficiency brings more money. The maximum pay seldom exceeds $25.00.

* * *

I may be floundering around a bit and I can't help it. I'm leading slowly into a subject that may disclose itself. It isn't consistent that keeping telephone girls three years should require constant recruiting and abnormal inducement. Here's the rub. Girls who go job-hunting seek the places which offer the greatest attraction. They do not pick out the disciplinary places. They are not craving careful inspection. What they want is fun, as much of it as they can get. The shops and department stores in cities require the least skill. You come and go by the clock. You get your "passes" at the whim of the boss. The system doesn't care beyond getting your time. You chat with your neighbors behind the counters or at your elbow along the bench or sewing tables. You gossip about the people who come and go. Mild flirtation isn't uncommon. There is excitement of the human sort and naturally it leads to boldness. If this life is compared with the quiet of switchboard operating you will observe a marked difference.

* * *

I have talked with the chiefs of departments employing telephone girls. The requirements are simple. Alertness; sweet voice, grammar school education; ability to write legibly; perfect sight and hearing; and *good health*. The normal girl a-job-hunting ought to qualify. The trouble is she tries other things first and by the time she has had experience and excitement, she tries the telephone company. And she usually falls down on the last requisite—*health*. Out of every hundred applicants for telephone switchboard operator, ninety-two are rejected. If the telephone companies would dare to make the record public there would be turmoil among the largest users

of its service. It would show that the telephone company must recruit its help from those girls who have tired of the "no discipline" positions. They come to the telephone company seeking the quiet and comforts of a pleasant environment and are safe from the contaminating influence of the mob. If charity organizations seek a new field of endeavor let them investigate the score of big operators' rejected applications and note the cause. Possibly they will find an occupation that will divert them from the cause of foreign missions. If I could talk to mothers I would make myself more clear, but men are strange animals, taken by and large, and they show unusual sagacity at times. For be it known that women do the examining and hiring of telephone girls. They are usually spinsters and believe me, my brothers, they have thoroughly good reason to be just what they are.

* * *

I want to make it quite clear that I am in whole sympathy with the employment department of metropolitan telephone companies, and I also go on record in favoring the telephone girl as a fine collective example of young womanhood. These girls can tell their mothers a great many things that mothers should know. They are patient, polite and painstaking. They care for themselves, as becomes the best of their sex. They combine all the essential qualifications which make men seek them out and marry them. They average high as wives and that element of health is borne out to the great satisfaction of the telephone company which should be more favorably and frequently known as the greatest girl rescue mission in the land. My prayer is that other large employers of young women might follow the same sensible rules that have made it hard for the telephone company to keep the faith with its public.

* * *

One of the mysteries of the telephone business—the independent portion of it—that gives me concern is this prolonged apathy. In the earlier days it wasn't unusual, when additional capital was required, to go to the financial men in the several operating districts, explain what was wanted and why, and come away with the wherewithal. It was a simple operation—either selling treasury stock or increasing capital account and issuing more. Today, it seems to be the practice to mark time; render the service at command and sit back to see what happens. I don't attribute this change to the public service commission that has been thrust upon us at our own thrusting demands. It doesn't hold water. While independents have been watching the clock and reading the arguments of their big rival, pointing to the beauties of a universal system, that same rival has been selling stock to beat the band. Of this we are all aware. In 1909 the American Telephone & Telegraph Company had a bonded debt of nearly a quarter of a billion dollars. Its capital stock was something more than one hundred and fifty millions —I haven't the exact figures, but the bonded debt has been reduced to less than a hundred million and the capital stock has been more than doubled. From my narrow conception of big affairs this makes a hit with me. Now it is also known that railroads can't turn tricks like that and I'm just foolish enough to believe that the real trouble with independents can be traced to themselves. I know this is pretty hot talk for hot weather, but I hate to see a particular brand of operators sitting around with their eyes shut and their fly-traps open. Better get a swatter.

To emphasize that the game is good if you'll get up on your toes and go to it, I want no better example than Chicago is offering. J. Ogden Armour has money enough of his own to do big things, but I never knew of a big man with money who kept right on playing with odds all against him. You and I know when he got his feet wet in telephones, but we never imagined he'd wade right in up to his neck and refuse the help of volunteer life savers. How far Mr. Armour has followed his millions into the Illinois Tunnel is a matter of record. The reorganization of the Tunnel Company was pretty well along when a $24,000,000 mortgage was filed June 29. The money was distributed around to the apparent satisfaction of everybody, and when it was discovered there would be something like $15,000,000 to spend in extensions of the automatic system, the same backers slid around and gathered in an option on 51 per cent of the stock of the manufactory of those Lizzie instruments. This is all in the game. It goes to show that capital and courage will hold telephony on a competitive basis and that caution and cowardice will kill it. There are hosts of little Armours in every community, but there are evidently too few operators who are ambitious enough to ferret them out.

* * *

Grandma Bemis has spoken. Hark ye: "What I have asked them to do is to get the information tabulated in such form in all its details so that it can be submitted by the corporation counsel to the committee in such a form that this committee can understand and act upon it." Now then, all together: "What's the matter with Bemis!" And to think they are still counting the automatic telephones in Chicago. Why don't they call up the subscribers. Aren't the numbers in the book?

* * *

No longer any doubt about the Detroit Home Telephone Company. The Michigan State picks it up for $3,500,000, cash. As a plant, there was never anything created by the independents that was more beautiful. The whole proposition was de luxe, except the credit side of the ledger and that was de nix. Somebody lost a lot of money in the Detroit fiasco. St. Louis contributed a cool million. The plant was supposed to have cost $5,000,000 or more. It had approximately 10,000 subscribers and when stations carry a lug of $500 per, something is bound to happen. The Home rate was too low and the Michigan State too chesty as a competitor. Plain case, based on fundamentals. If a tear would help, I'd shed it.

* * *

One of the lawyers got sick at Rochester and all those U. S. I. cases go over till September. Good hot weather item.

* * *

I have had my eye on the recent activities at Rochester, and would be glad to quote George R. Fuller, but discretion has taught me to lie low. I don't agree with all Brother Fuller has to offer on the subject of competitive telephony. He may be right on the function of public service commissions, but time will have to prove him out. When he opines that independent telephony is passing, I fear he forgets to reckon with his old host. Independent telephony, so-called, may be a thing of the past at Rochester,

but a unified system without monopoly of control will continue right along for years to come. I am sure if the curve has reached a low point today, it will have an upward tendency from now on. It is an old rule that men are prone to judge things by what they see before their eyes. Rochester is a beautiful city—a city of roses, but it is not the whole country. Beauty and flowers and blue skies and creamy clouds breed dreams. Brother Fuller will wake up, after a while.

* * *

Nobody sent me notice that Hank Evans had returned from his tour of the world. It was not necessary. Hank had not much more than landed at Aurora and put away his steamer rugs and trunks, before his old friend, Hi Wagner, lit into him like a falling wall. It is not my quarrel and I never was much good as a referee. Women usually have their way and the last word. Hank must be some kin to the fair sex, because his way was to dispose of Inter-State bonds and his last word sounds like he called Hi Wagner a prevaricator. What is really exciting is his further charge that E. R. Conklin put the Inter-State-Bell deal through. Hank says he got 66⅔ for $425,000 worth of bonds that he held, which confirms some fleeting remarks I recorded at the time in this emporium of an old woman's brain leaks. While the Chicago Telephone Company was gathering in about $1,200,000 worth of these bonds, at approximately 58, it also got a lot of the stock at about $2 per share, but a few of the wise ones at Aurora thought better of the stock and held on to it. That accounts for the control of Inter-State by the independents. A stranger thing than all this is the threatened invasion of new capital to promote the Inter-State system. Rumor has it that a strictly new crowd of men, hailing from Ohio, have formed a syndicate to buy the Inter-State control. This new crowd wants the Inter-State badly, at a given figure, but the offer is contingent upon Hi Wagner dropping his suit against Hank Evans. Don't it beat the Dutch how lucky some men are? Here is another proposition that looks queer to a casual, long-range onlooker. This "powerful syndicate" is to give a note for the property. The amount of this note will just pay the deferred interest of $2,350,000 worth of bonds. Then Fred Dolph, the thousand a month receiver of the Inter-State will be fired, or maybe he will be discharged—it will be one thing or the other. By these simple manipulations the Chicago Telephone Company will not be able to foreclose on its bonds and it is also alleged that it cannot dominate the affairs of the concern. Curiosity prompts me to wonder whether the Chicago Telephone Company is crazy about doing those things.

The Passing of Romance

"'Click—click—click' went the telegraph sounder, and out in the wilderness in an isolated way station of a great trans-continental railroad sat the lonely night operator, his ears strained to catch every dot and dash and his eyes glued to the spot, now nothing but a blot of murky darkness, where he knew the flashing headlight of the 'Overland Limited' would first meet his gaze. Around about, through the partly opened window, the only sounds were the dismal howling of the coyotes and the swishing of the wind through the ravines. The interior of the station was poorly illumined by the fitful glare of a smoky kerosene lamp. It was no easy matter to keep one's senses alert under such conditions. Suddenly the station call came in on the sounder — — — — SX — SX — it clicked. The drowsy operator sat up with a start ——"

No more will the romantic writer picture such scenes, for, with the continued and steady introduction of the telephone on railroad systems for handling and controlling the movements of trains, such conditions will be things of the past within a very short time. So does the halo of romance, with which the night telegraph-operator of the plains and the wilderness has been surrounded, fade away before the remorseless advance of the bright and more efficient light of modernism.

The new order of things makes it perfectly feasible to do away with the night operator at the isolated way-stations. A Western Electric Company railway specialist recently mentioned the fact that one railway system, to which he had sold telephone train dispatching equipment, had done just this thing and that each passenger and freight conductor has been furnished with a so-called "master-key" for the stations along the line to enable him to enter, lift the telephone receiver from the hook, put himself in instant communication with the train dispatcher at headquarters, receive his orders verbally and go on his way.

Not very romantic but surely economical and highly efficient.

New Type of Long Distance

The Homberg-Niederrhein Colliery power distribution scheme includes 38 kms. (nearly 24 miles), of aerial telephone cable, according to *Electricity*, of London, which is specially remarkable in that it is carried immediately below the 10,000 volt power lines, and yet is immune from inductive interference from the latter, and is unaffected by earthing of the high tension lines. This cable, the first of its class, was patented and installed by Siemens Halske in 1909, and has been in perfectly satisfactory operation ever since.

The core of the cable is paper insulated, and iron sheathing is used instead of lead. The line is hung flexibly from the bottom cross arms of the power line poles and all swaying of the cable is thus taken freely past the points of suspension. Pupin coils, placed in suspended sleeves, which also serve as connecting sleeves, reduce the copper cost of the cable and improve speech transmission.

Erection of the special cable proceeds just as in the case of any other aerial line. In each tie to tie span, one end of the cable is clamped and tension is then applied at the other end by hoisting tackle, through an indicating dynamometer; when the tension reaches the desired value, the second end of the span is secured. Sharp bends and kinks are avoided by taking the cable over rolls from the tension tackle to the masts.

The cable sheathing is used as earthing conductors for all the iron masts, and each connecting and Pupin sleeve is specially earthed, so that an earth on one of the high tension lines can produce no in leakage or other interruption in the telephone cable.

Some Applications from Would-Be Operators

Interesting reading may be found in the applications of some young ladies for positions as operators. *Telephone Talk* culls a few of these flowers of caligraphy and orthography for the delectation of its readers.

The first point that strikes us in regard to these is the marvelous possibilities of the English language. If there is any chance to make a mistake, and even sometimes when there is no reasonable chance, that mistake is sure to be made. One girl has resided at Vancouver "one and hafe year"; she is an "Amaercan," and has been employed at "opertoring."

Almost every occupation seems to be represented among the applicants. There are girls who have been "domestically engaged at home," "general severants," "clercks," "superivisors," and others who have been "operatating," through every trade and profession, to those who have "not been out before."

And the most curious reasons are given for leaving these situations. "Because I took a bad cold," "on account of steam," "too quitt," "mutual consent," "oblidge to," "it was very cold," "coming West," are some specimens. One young lady "could not stand the constant standing," another "kneeded a rest," while another was "not well," and had a "change predicted."

Every nationality under the sun, it would seem, sends its fair ones to do homage to the telephone company. English, Scotch, Irish, German, French, Jewish, Norwegian, Swedish are jumbled hopelessly with Canadians and Americans. Even far-away Iceland has sent a daughter to the land of corn and wine; and one girl even had the courage in these sinful times to acknowledge her nationality as "Church of England." By the way, there are quite a number of ways to spell American besides that mentioned above. "Amarican," "Amercan" and "Americian" are interesting variations.

One applicant states that she has resided in Vancouver "fifeteen months," another that she does not reside with her parents, but with her mother. Another tells us, in answer to the question on health, that "I have no particular trouble," and to the question "Do you speak English fluently?" she replies, "All the English have." Another, to a question as to whether she has been employed as telephone operator, answers with great assurance, "Know."

But the crowning glory was one written by Mrs. Emily R f T——, age 29, residence at — Pender street east, who was "English born." She tells pathetically that her "husband gon may be dead." She was last employed "at my boarding house," and adds the information, "i can turn my head and hands to do aney thing." Evidently the Traffic Department did not consider her abilities as equalling her confidence, for her application was not accepted.

Cable Testing by Compressed Air

The central telephone exchange in Hamburg, Germany, has installed a compressed air plant for testing underground cables and for cleaning and dusting the furniture and apparatus of the exchange. The plant, which is installed in the basement, consists of a ten-horsepower motor, a compressor, and an air vessel for cooling and purifying the air. Compressed air pipes run throughout the building for cleaning purposes.

The paper-insulated cables used in Hamburg have at a distance of about 100 feet from the exchange a soldered joint with a threaded cock which communicates with the interior of the cable and is closed by an air-tight screw cap. When the cable is to be tested the cap is removed and a threaded T-union with a pressure gauge on one end and the connection to the compressor air hose on the other end, is screwed over the cock. A simple union with a guage only, is screwed over a similar cock at the other end of the cable section which is to be tested. If the cable is sounded, this second gauge will show an increase of pressure due to the inflow of compressed air. Of course, in a well-made cable there is not much of an air space, so the final gauge reading should not be taken until some time has elapsed, perhaps as much as two and a half or three hours. Even after this lapse of time the gauge at the farther end of the cable will not read nearly as high as the gauge near the compressor, but if there is any appreciable increase in pressure the cable may be passed as sound. If the farther gauge shows only a slight increase in pressure, or none at all, the cable sheath has a leak at some point. A longer test can be made by enclosing compressed air in a cable section for several days. If, after that time, the pressure is relatively the same as it was, the cable sheath is sound. Sometimes cracks can be located in the sheath by listening for the hissing of the air as it escapes.

This compressing equipment has proved itself a valuable asset in the Hamburg exchange. Where water had entered conduits and soaked the cable, compressed air was used to force out the water. In one case, the paper insulation of a cable had become water soaked. The cable was dried by compressed air continually for fifty hours, and thirty-five hours after this it was in operating condition again.

The entire cost of the Hamburg plant was $2,792, which included the cost of the vacuum cleaning equipment as well as the testing and drying apparatus. The care of the plant entails no extra expenditure as the work is simply added to that of the regular staff.

The Hamburg officials feel that the compressor system has saved them thousands of dollars and considerable valuable time in locating leaks in cable and in drying out cables that had been flooded.

Telephone Pioneers Reunion in November

At a meeting of the executive committee of the Telephone Pioneers of America, July 17, it was voted that the second annual reunion of the association will be held at New York City, Thursday and Friday, November 14 and 15. H. F. Thurber, Gerald Swope, H. S. Brooke, A. S. Hibbard and H. W. Pope were appointed as a general committee of arrangements with power to add to their number as may be necessary. Information will be forwarded each member as early as practicable.

Telephones in Algeria

A comprehensive system of telephones is about to be set up throughout Algeria, the chambers of commerce of the leading cities having been authorized to advance the necessary funds to the general government.

The Vibration of Telephone Diaphragms

By Charles F. Meyer and J. B. Whitehead*

INVESTIGATIONS by Rayleigh and Wien on telephone diaphragms in which the value of the simple harmonic current was measured that would just produce an audible sound have shown that at certain frequences, the current required was a minimum. Wien concluded that these mimina showed the existence of natural diaphragm vibrations, but realized that the variation in the sensibility of the ear, with pitch, played possibly a larger part in the difference in current requirements at different frequencies than the natural vibrations. Kempf-Hartmann fastened a mirror on the diaphragm and by a spot of light photographed the oscillations on a moving film. With direct current interrupted about one hundred times per second passed through the receiver he photographed the natural oscillation produced at each make and break, and also showed that when the diaphragm had been given an impulse its reaction could be detected after about 1/2000 of a second.

Taylor plotted curves showing the connection between the least current required for an audible sound, and the frequency, his works being similar to that of Rayleigh and Wien. He showed that as the alternating current generator was accelerated or slowed down there were certain frequencies at which the sound from the receiver was very much increased.

Fig. 1.—Receiver Cap. The Shaded Portion Was Cut Away for Mirror.

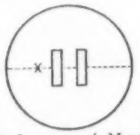


Fig. 2.—The X Marks the Position of Mirror on the Receiver Diaphragm.

Gati produced before the diaphragm sounds of varying frequency, but with constant amplitude. The transmitter was in circuit with a battery and the primary of a transformer. A capacity was connected to the secondary to produce electrical resonance at each frequency, and measured the secondary current. He found a decided maximum at about 700 vibrations per second.

The mathematical theory of the free oscillations of a circular plate has been developed, and shows that the nodes are either circles about the center; or diameters symmetrically distributed for plates with a free or fixed boundary. Rayleigh gives the following formula for the frequency of the lowest natural vibration of a clamped plate.

$$N = \frac{3.2^2 \sqrt{qh}}{2\pi a^2 \sqrt{3\rho (1-\mu^2)}}$$

q = Young's modulus.
μ = Poisson's ratio.
ρ = Volume density.
$2h$ = Thickness of plate.
a = Radius of plate.

The object of the experiments of the authors was to obtain further information concerning the way in which receiver and transmitter diaphragms vibrate when acted on by periodic forces of simple wave form, and different frequencies. Also to obtain quantitative data on the influence of free periods, and to determine to what degree of approximation the form of diaphragm vibration follows the impressed force.

With the receiver, the simplest of the two devices, the problem was to pass an alternating current of simple wave form through the coils and to record the form of the current and corresponding diaphragm oscillation. The amplitude of diaphragm oscillation for the same current at different frequencies plotted against frequency would give the resonance diaphragm curve.

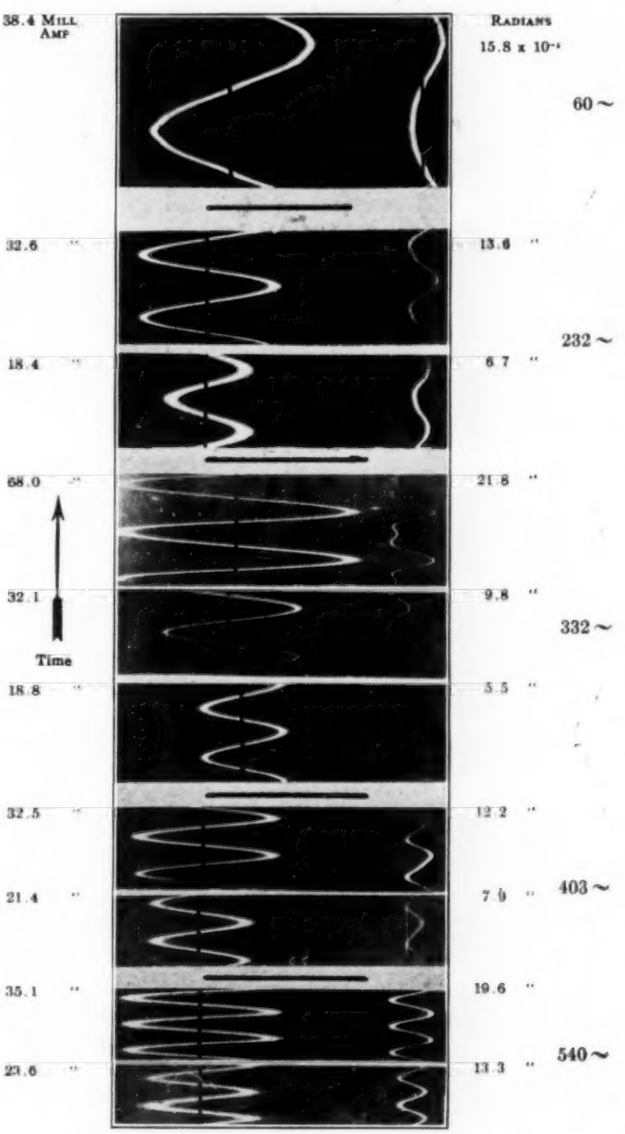


Fig. 3.—Photographic Oscillograph Curves of Receiver A.

Two special alternating current generators with smooth body armatures, were used for low fre-

*A paper read at the 29th annual convention of the American Institute of Electrical Engineers, Boston, Mass., June 27, 1912.

quencies. For the principal range a third generator was used, and with the three machines frequnecies from 16~ to 3000~ could be obtained. Wave form was recorded by a Duddel double high frequency oscillograph with a free period of from 8,000 to 10,000. This instrument was used both as an oscillograph and ammeter simultaneously. A small mirror was cemented directly on the diaphragm and its vibrations were recorded by a spot of light reflected on a photographic plate. As the weight of the mirror was

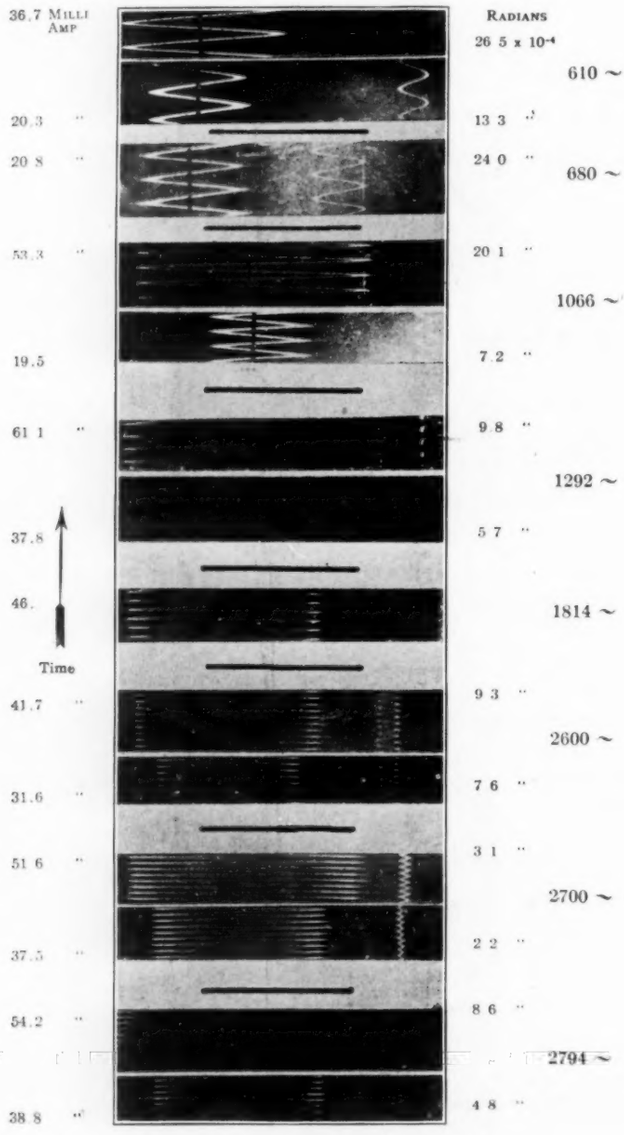


Fig. 4.—Oscillograph Curves of Receiver A.

only 0.007 gram it did not influence the diaphragm. The first receiver was an ordinary bipolar, with a 2.14 inch diaphragm, the effective diameter due to the clamp ring was reduced to 1.96 inches.

The thickness, over the enamel, was 0.012 and 0.009 inch on the bare metal. Distance between normal position of diaphragm, and the face of pole piece was 0.02 inch. but the actual air gap was less than this because of the attraction of the magnet. The mirror was placed about half way between the center and the edge, and with the diaphragm oriented over the poles. The mirror came on the perpendicular bisector.

The curves on the left of Figs. 3 and 4 are records of the current in the receiver with the current in milliamperes at the side. The curves on the right are the traces from the diaphragm, the figures at the right side giving the angular deflection in radians $\times 10-4$. As these curves are unsymmetrical their amplitudes are impossible, so that the total deflection from one extremity to the other is given, hereinafter referred to as the "range." The extreme right hand figures give the frequency of vibrations in cycles per second. Time proceeds upwardly.

The diaphragm trace for 60 cycles is unsymmetrical, the curve being pointed with the diaphragm nearest the poles. At 232~ at a range of 13.6 the curve is unsymmetrical, but for a range of 6.7 the irregularity is less marked. At 332~ and 1292~ the irregularities are greater for greater ranges, but is not noticeable for other anges. For 332 and 1292~ the development of a dimple where the diaphragm is furthest from the poles is surprising.

The force on the diaphragm is proportional to the square of the induction, and if we consider the induction B as made up of a constant part B_0 due to the permanent magnetism, and a variable part B_1 due to the current, we have $F_0 = c B_0^2$, and for the variable, $F = c B^2 = c [B_0^2 + 2 B_0 B_1 + B_1^2]$.

The increment of the variable over the original force determines the motion of the diaphragm, and is,

$$\triangle F = F - F_0 = c [2 B_0 B_1 + B_1^2],$$

and if B_1 is very small we can neglect the square,

$$\triangle F = 2c B_0 B_1.$$

So, that if B_1 varies harmonically, $\triangle F$ will do so. The currents have been kept nearly harmonic. A variation in the air gap would prevent B_1 from being strictly proportional to the current, but for small vibrations the influence of the variation may be neglected.

Figs. 8, 9 and 10 show the results obtained for the first diaphragm in which the abscissae is the current through the receiver in milliamperes, and the ordinates are the angular range of diaphragm oscillation expressed in radians $\times 10^{-4}$. They show that an approximately linear relation exists between the current and deflection, even with large currents. The angular oscillation corresponding to a current of 20 milliamperes at the frequency for which the curve is taken can be read on all three curves.

In Fig. 11 the curve is platted with frequency as abscissa, and the angular oscillation as ordinate showing the effect of a change in frequency, this being the resonance curve of the diaphragm. It starts out horizontally, drops to a minimum at 300~, and reaches a maximum at 720~, at which the range of oscillation is five times that at minimum, and four times that at the lowest frequency. After 720~ there is no maximum until 2,600~. It is surprising to find the minimum at 300, before the first maximum, but as it occurred also in the curve of the next receiver tested, it is a real effect.

The damping of the diaphragm is not purely mechanical, but is in part electro-magnetic, and this may have a bearing on the subject. The electromagnetic damping is made up of two parts, one being due to eddy currents from the permanent field, and the other due to hysteresis and eddy currents caused by the current. The latter would increase with the fre-

quency, so the damping is not constant, but increases with the frequency. Fig. 11, covers the range of frequencies existing in the human voice, the lowest tone being about 65 vibrations, and the highest 1,036. These are reached in singing, but the tone of 1,036

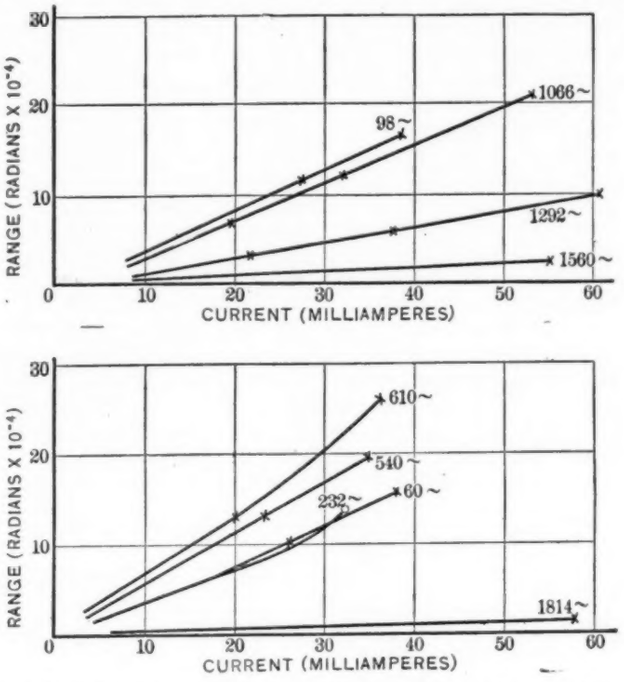


Fig. 8.—Relation Between Current Through Receiver and Range of Oscillations of the Diaphragm at Different Frequencies.

contains harmonics of a higher order. Vowel sounds range from 575 to 2,050, according to Bevier, and the consonants, especially of the hissing type go as high as 10,000.

As consonants are not as important in speech as vowels, the most prominent vibrations are included between 300 and 3,000, not many, probably, being above 2,000. The greatest ordinate of the curve comes at 720, and lies at a somewhat less frequency than its free vibrations, the actual frequency is less than if there were no damping. Rayleigh's formula gives $\eta = 890$, and a calculation from the values in Fig. 11 shows that the free frequency of the diaphragm without damping would be 732, not a very close agreement. The enamel may be the cause as it loads the diaphragm without adding much to its stiffness, causing the actual value to be less than the calculated. Neither the measurement of thickness, nor the value of Young's modulus were accurately determined and this may introduce another element of error.

In tests with another receiver it was desirable to ascertain whether the mirror affected the range or form of oscillation, so in this test the current was kept nearly constant for each plate. One section was exposed with a load of 8 mg. of wax placed on the diaphragm as near the mirror as possible, and the other section was exposed without the load, as shown in Fig. 5. In none of the plates is there a noticeable difference in wave form or range with or without the load.

When a circular plate vibrates freely, the nodes are circles and diameters, and when clamped, the nodes may be located as shown in Fig 13, the nodes of vibration are shown in the order of ascending frequency. It cannot be said in advance which ones will occur or to what extent, as this depends on the frequency of the impressed force and the method of its application, so it can be determined only by experiment. With the mirror fixed in one spot, the motion of the diaphragm cannot be learned.

The light spot ordinarily vibrated in a horizontal direction, as if of a motion of the diaphragm as a whole, or with an internal node, which will be called "circular vibrations." At certain frequencies, the spot vibrated obliquely instead of horizontally, and this motion would be caused by superimposing on the circular vibration, one having one or more diameters as nodes. This motion will be known as "diametral. This cannot be symmetrical about the diaphragm center. It is not evident why diametral vibration should exist if the diaphragm is symmetrical about the poles and its center. Symmetry was tested for by rotating the poles, and it was found that the diametral component changed markedly as the poles rotated, moving the light shot from a maximum to minimum in about half a revolution.

It was also noticed that there was a change in the intensity of sound during rotation which could not exist if the diaphragm were symmetrical. Further tests were made to determine whether this was the result of mechanical imperfections in the rotating parts or the grain of the diaphragm as suggested by Kempf-Hartmann. It was found that the element of mechanical imperfection played only a small part, if any, and no decision could be made between the

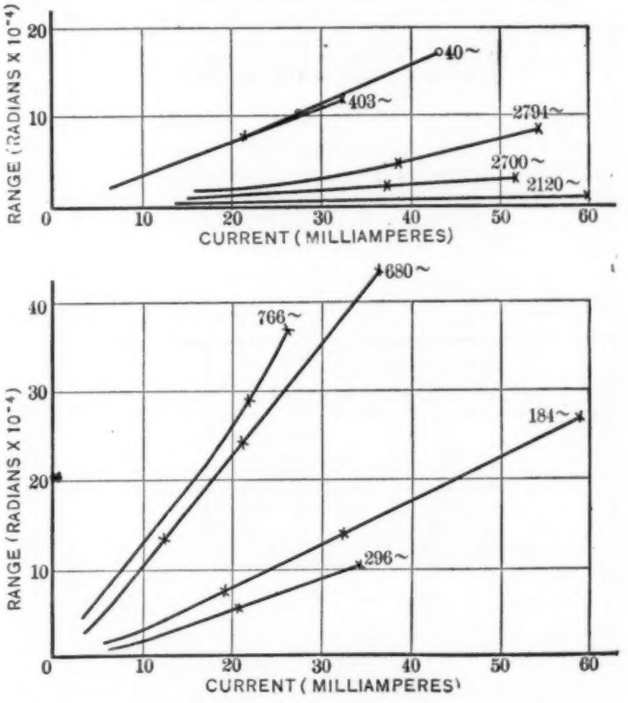


Fig. 9.—Relation Between Current Through the Receiver and Range of Oscillations of the Diaphragm at Different Frequencies.

mirror and the grain, but it is thought that this can be done in the future. If the orientation of the grain affects the extent of the diametral vibrations it would be a matter of some importance. Whether it affects the transmission of speech, it is difficult to say.

The amplitude of circular vibration is small between the fundamental and next higher resonance tones, and sounds of certain pitch are much magnified in relation to others. Frequencies of vibration with one diameter and two diameters as nodes lie below

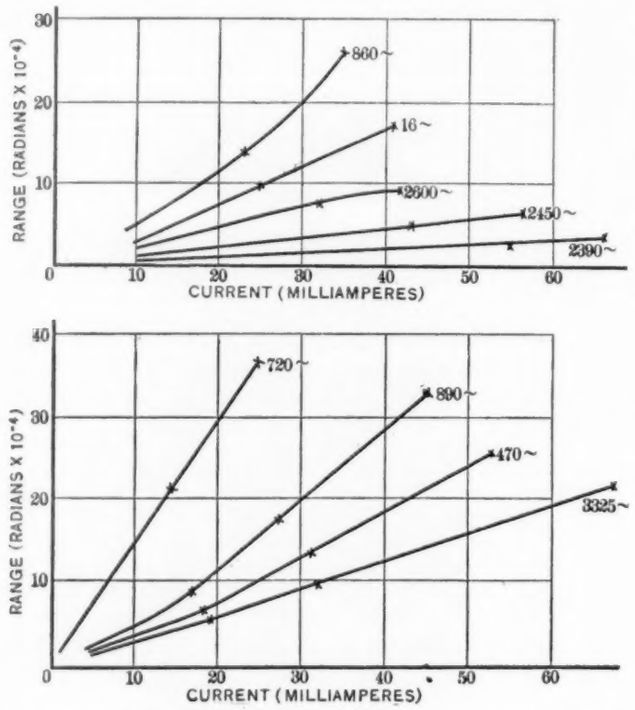


Fig. 10.—Relation Between Current Through the Receiver and Range of Oscillation of the Diaphragm at Different Frequencies.

the frequency for the second circular vibration. It appears possible that a diaphragm may take up these nodes by properly orienting it over the poles, or by proper loading. It may be possible by introducing the diametral vibrations, both in the transmitter and receiver, and by choosing the proper size diaphragm, to have the maxima of resonance of one diaphragm coincide with the minima of resonance of the other,

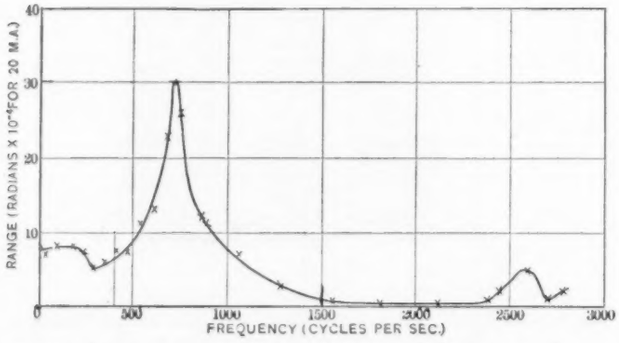


Fig. 11.—Resonance Curve for Diaphragm A, giving the Relation Between Frequency and Range of Oscillation for a Constant Current.

to obtain more nearly the relation between the amplitudes of sounds of different frequencies.

In actual use the diaphragm of the transmitter is acted on by sound waves but it is impossible to get a source of sound for experimental purposes that is sufficiently loud and at the same time of pure tone. For this reason, and because of the waves set up by the walls of the laboratory, the vibration was caused magnetically by means of a receiver magnet. The magnet of a receiver was mounted in front of the transmitter, and a small iron desk was shellaced to the diaphragm for an armature, as the diaphragm was of aluminum. Current from an alternating current generator was passed through the receiver coil, and the current wave recorded on the oscillograph. Current from a storage battery was passed through the transmitter, and the second vibrator of the oscillograph in series, and the variation of the current in the transmitter due to the vibration of the diaphragm was recorded on the same photographic plate on which the current curve through the magnet was taken. The variation of current in the transmitter was taken as a measure of the oscillation of the diaphragm.

The electrical connections are shown by Fig. 14. In one circuit, known as the "magnet circuit," the high frequency generator G, the oscillograph O_1, the magnet coil F and the resistance R, are in series. In the other, or "Transmitter circuit," the current flows from the storage battery B, to the diaphragm D through the carbon granules box of the transmitter C,

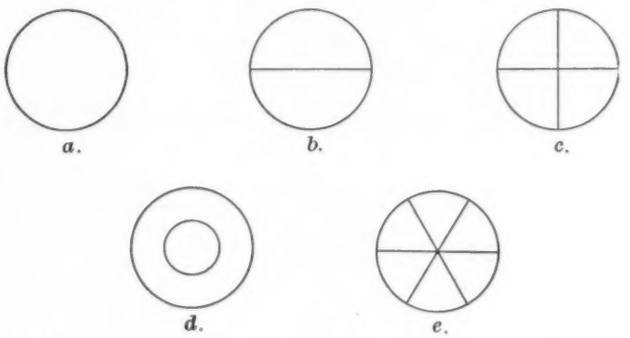


Fig. 13.—Representing the Five Lowest Modes of Free Vibration of a Circular Diaphragm.

a.—The Boundary as the Only Node—Diaphragm Vibrating as a Whole.
b.—One Diameter as a Node—The Two Halves Vibrating in Opposite Phase.
c.—Two Diameters as Nodes—Adjacent Quadrants Are in Opposite Phase.
d.—Two Circles as Nodes—Inner and Outer Areas Are in Opposite Phase.
e.—Three Diameters as Nodes—Adjacent Sectors Are in Opposite Phase.

to the oscillograph O_2, and through the milliameter A back to the battery. Three cells were used with the voltage constant at 2.9 volts throughout. The two circuits had the point E in common at which they were connected to earth.

The alternating current in F causes diaphragm D to vibrate. Before the vibration begins, the transmitter current is steady, and can be read at A, a steady deflection of O_2 also being caused. When diaphragm vibrates, the current variations are recorded by O_2. The traces for the transmitter in general show much more distortion than those of the receiver.

SUMMARY OF RESULTS.

Photographs has been obtained showing the vibration of receiver diaphragms when approximately harmonic currents are passed through the receiver.

These show considerable distortion at some frequencies and very little at others. At any one frequency the distortion is less for smaller currents. This is what would be expected from *a priori* consideration.

An approximately linear relation has been shown to exist between current and amplitude of oscillation of the diaphragm over the range of work, which extends well beyond that of practice. Resonance curves for two receiver diaphragms have been plotted giving quantitative data of the influence of the natural period of the diaphragm.

The effect of a small load on the form and range of the oscillation was examined. Its influence could not be detected except in one instance in which there was possibly a slight effect on the range of oscillation.

Diametrical vibrations of the diaphragm were observed in cases in which they would not have been expected from the apparent symmetry of the instrument. The orientation of the diaphragm over the

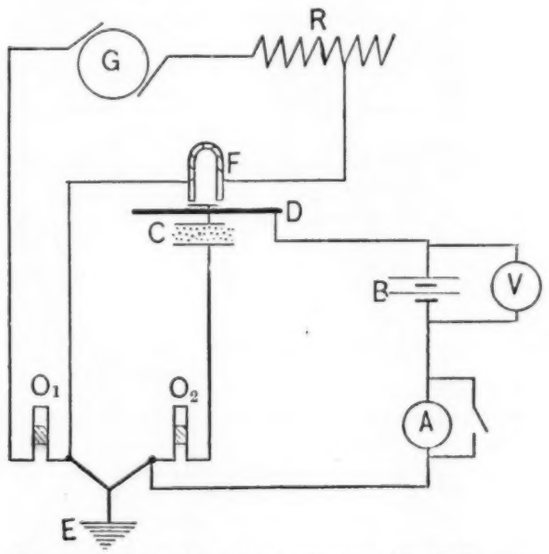


Fig. 14.—Electrical Connections in Working with the Transmitter.

pole pieces was observed to have a marked effect. It has not been experimentally settled whether this is due to the mirror or the grain of the plate, but it is difficult to see how a mirror weighing only 4 mg. could cause the vibrations. It is suggested that by properly introducing "diametral" vibrations the transmission of speech might be improved.

Photographs have been obtained showing the variation of current in the transmitter when an approximately harmonic force acts on the diaphragm. These show a rather marked distortion even for the lowest exciting force used, which was very much lower than the lowest force used on the receiver diaphragm. These distorted curves may be just reversed from their normal form when the microphone is in a certain abnormal state.

An approximately linear relation exists over the range examined between the variation in current and the exciting force. The resonance curve of the transmitter is given showing very marked maxima and minima. The first maximum is attributed to the fundamental period of the diaphragm vibrating as a whole. The second maximum is attributed to the diaphragm vibrating in an irregular configuration on account of the damping springs.

Arnold Bennett on the Telephone

Arnold Bennett, in the July issue of *Harper's Magazine*, says: "It is the efficiency of the telephone that makes it irresistible to a great people whose passion is to 'get results'—the instancy with which the communication is given, and the clear loudness of the telephone's voice in reply to yours: phenomena utterly unknown in Europe. Were I to inhabit the United States, I should become a victim to the telephone habit, as it is practised in its most advanced form in those suburban communities to which I have already incidentally referred. There a woman takes to the telephone as women in more decadent lands take to morphia. You can see her at morn at her bedroom window, pouring confidences into her telephone, thus combining the joy of an innocent vice with the healthy freshness of breeze and sunshine."

Visiting one of the big telephone exchanges of New York, Mr. Bennett was impressed with the ingenuity of the system which made it possible for the millions of incoming and outgoing calls to be handled so dexterously and, with so much exactitude. He says: "A murmuring sound, as of an infinity of scholars in a primary school conning their lessons, and a long row of young women seated in a dim radiance on a long row of precisely similar stools, before a long apparatus of holes and pegs and pieces of elastic cord, all extremely intent: that was the first broad impression. One saw at once that none of these young women had a single moment to spare; they were all involved in the tremendous machine, part of it, keeping pace with it and in it, and not daring to take their eyes off it for an instant, lest they should sin against it. What they were droning about, it was impossible to guess; for if one stationed oneself close to any particular wrapt young woman, she seemed to utter no sound, but simply and without ceasing to peg and unpeg holes at random among the thousands of holes before her, apparently in obedience to the signaling of faint, tiny lights that in thousands continually expired and were rekindled. It was so that these tiny lights should be distinguishable that the illumination of the secret and finely appointed chamber was kept dim. Throughout the whole length of the apparatus the colored elastic cords to which the pegs were attached kept crossing one another in fantistic patterns."

Foreign Telephone Supplies

A commission composed of certain government officials in a foreign country has finished a tour of inspection of the country made with a view to studying certain measures of reform and to consider at a later date more complicated questions. The commission has made an allowance of $96,800 for the installation of government telephones. A British subject resident in the country proposes to bid for these, and he has requested an American consul to secure for him catalogues and price list of all kinds of material entering into the construction of a telephone system of about 150 miles.

Steel Channel for Cross Arms

A Successful Innovation

BY SUBSTITUTING standard structural steel sections for the usual wood members, Charles G. Ette of St. Louis, Mo., has presented an entirely new and ingenious solution of the cross arm problem. In designing this system, the inventor took into account not only the question of quality, but also the equally important factors of weight and cost. Any of the steel arms will outlast the life of any three wooden arms, even the specially treated fir woods, and effect a great saving even in the first cost.

Taking the average life of a wood pole as 20 years, and the life of the arms at 7 years, the style of steel arm shown in this description would save $20 or over for each arm during the life of the pole, besides the saving in first cost. Assembling a pair of Type "A" pins requires practically the same amount of time as two Western Union pins, and if there is any difference in this regard it is in favor of the Type "A," handling 5 steel arms, 77 inches each, with 60 pins, against 6 wood arms, 10 feet each, with 60 pins.

The steel channel used for cross arm purposes is a standard commercial channel 4-inch web and 1⅝-inch flanges, tapered on inside from ⅛-inch to 5-16-inch and weighing 5¼ pounds to the foot. This steel is quoted on December, 1911, at $1.30 per 100 pounds f. o. b. Pittsburg, cut to lengths and holes punched as shown, by Cambria Steel and other companies. For this purpose a lighter arm, weighing 1 pound per foot less, or 4¼ pounds, could also be especially rolled and used, as its tensile strength is more than 18 times greater than wood arms. A special channel arm can also be bent from a cold steel plate, 3-16-inch in thickness, at still less price.

Pins for type "A" telephone and telegraph are arranged 12 pins per arm, instead of 10 pins in wood arm; 6 of these pins extend above arm and 6 below in staggered relation to each other, yet the 12 inches distance between heads is maintained and even exceeded, necessitating only a 77-inch steel arm against

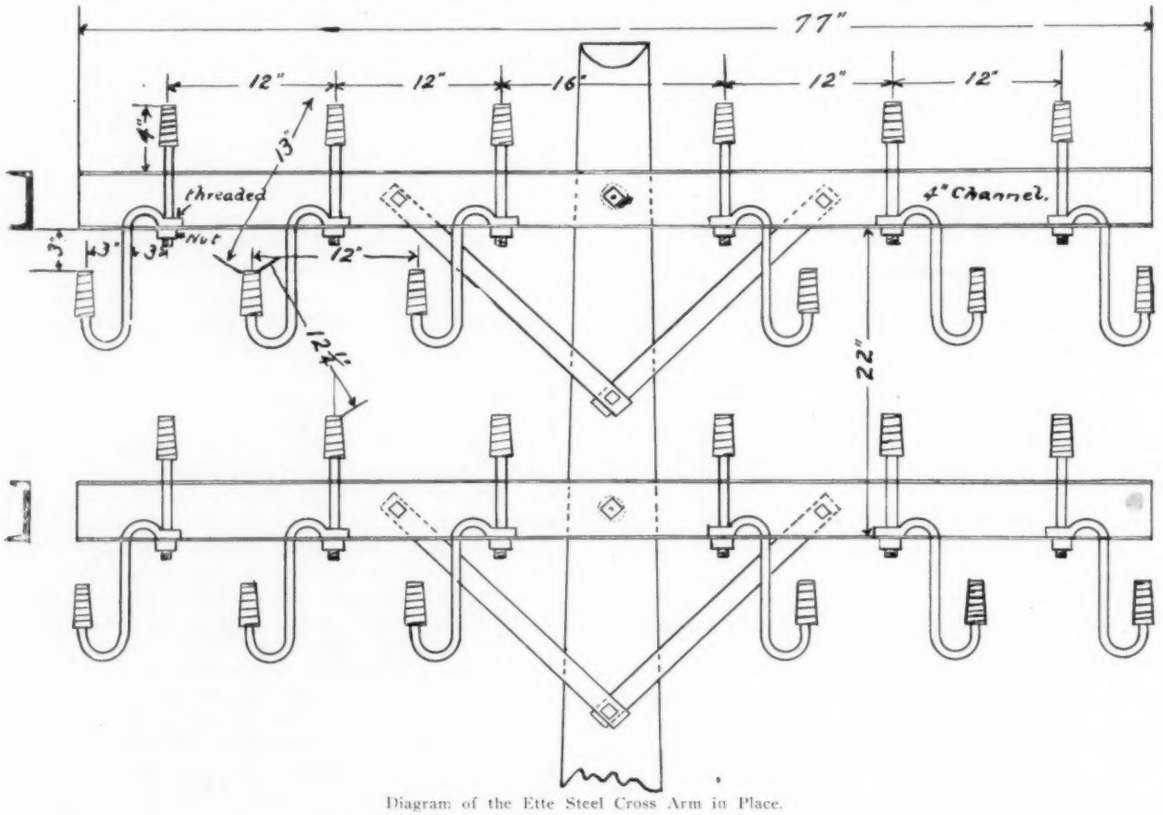


Diagram of the Ette Steel Cross Arm in Place.

120 wood arm, 16-inch space between pins at pole. These pins are made of special ½-inch steel, quoted at $1.10 per 100 pounds, f. o. b. Pittsburg. The standard Western Union steel pins, ½-inch with thread at top and bottom and wood head at top and nut and washer at bottom and heavy forged shoulder at top of cross arm, from ½-inch steel is quoted at 2¾ cents plain for each pin in large quantities.

The top pin is exactly like Western Union in every respect, except that the forged shoulder is omitted, saving nearly 30 per cent cost of pin. The type "A" downwardly projecting pins, into which the upper pin screws between the flanges of arm, is made of ½-inch steel, flattened cold at top, with ½-inch hole punched and threaded. It is also threaded at bottom

and double, bent cold as shown, which with wood heads and complete with upper pins is quoted at 4½ cents per pair, against 5½ cents per pair of Western Union pins or ½ cent saving each pin.

Note that when the upper pin is screwed into lower pin between flanges, the nut under the lower flange acts as a jam nut, therefore, there is less liability of it running off, and even if nut runs off, pins are still united between flanges and cannot leave arm.

The lower nut can be dispensed with and lower the end of pin bent not over 10 degrees by slipping over threads a small piece of gas pipe and giving same a blow of hammer, making even a more positive connection to arm. Either way prevents turning.

Type "A" arms have a spacing between all heads of 12 to 13 inches horizontally, opening at pole 16 inches and sagging space between wires 22 inches. Wood arm spacing of head 12 inches horizontally, pole opening 16 inches, sagging 18 inches. Any company erecting two of these arms and putting on wires according to American T. & T. Co. specification will demonstrate that wires through sagging have greater element and space of safety in type "A" construction, with pins under arm in staggered relation, as shown in cut, than in wood arm construction. For transposition of wires simply bend lower pin in the opposite direction.

The wind stresses on the pole are much reduced, because of the small area presented by the type "A" arms, five of which, 77x4 inches having an area of 128 square feet, against the 270 square feet presented by the equivalent 6 wooden arms, 120x4¼ inches. This is practically a 40 per cent reduction of stress.

Five of type "A" steel 77-inch arms, weighing with pins 206 pounds, are raised and attached to pole for less expense than 6 wood, 10-foot arms, weighing 276 pounds, with pins.

Five bolts are used against 6 for wood, and as the steel arm is ¼-inch thick and wood 3¼ inches, we save 3 inches in the length of bolts. The braces for 10-foot wood arm are usually 24 inches long. For type "A" 77-inch arm, an 18-inch brace is sufficient. Only 5 pair braces are used for steel arm, against 6 pair for wood arm.

As will be seen from the accompanying table of comparative costs, the total saving in first cost is over $1.25 to $2.00 per pole, and considering two renewals to the life of pole in the case of wood construction, the saving is well over $12 to $16 per pole during the average 20-year life.

WOOD AND METAL ARMS AND METAL PINS.

	WOOD	METAL
Six 10-ft. yellow pine arm holes, drilled and not painted, @ 44c	$2.64	...
Five steel arms, 4-inch channel, 5¼ lbs foot, 77 inches, 33.3 lbs. @ $1.32½ f. o. b. Pittsburg, by Cambria Steel Company, cut to lengths and holes punched, $44.11 each arm	...	$2.20
Sixty Western Union Pins @ 2¾c	1.65	...
Sixty pins, as Type "A," @ 4½c pair	...	1.35
Assembling to arms—same cost.		
Six 14¾-in. bolts @ 6½c	.39	...
Five 11¾-in. bolts @ 5½c	...	.28
Six pair 24-in. braces @ 10¾c	.65	...
Five pair 20-in. braces @ 9c	...	.45
Painting 6 wood arms, oil, @ 5c each	.30	...
Dipping 5 arms rabok, graphite, @ 3c	...	.15
Total	$5.63	$4.43
Add for fir arms 7c each extra	.42	...
Total	$6.05	...

In addition to the above it saves the difference in cost of putting up one less arm in steel, saves 70 pounds freight charges, 276 pounds for 6 wood arms and pins and 206 pounds metal arms and pins. It saves renewals of at least 2 wood arms to each steel arm. Man strings all wires from pole without climbing on arms. The pins cannot get off arm if nut runs off. These arms can be hot-galvanized at ¾ cent per pound or electro-galvanized at a trifle less per pound at present price of spelter. Type "A" arms and pins can be bought for same price galvanized as wood arms painted, all costs of wood renewals being a clear profit.

Rabok's graphite paint can also be used, either with or without galvanizing. This paint is an invention of a St. Louis company, which claims this paint has been adopted by English and United States navies for steel hulls, the Pullman Palace Car Company, for truck castings and roofs of their cars; also piping by the Western Electric Company for all underground cables and many others. It guarantees its paint on steel and iron against heat and rust for four years. It is sold in small quantities at 80 cents per gallon and is subject to thinning. Arms complete with heads and pins can be double-dipped at a cost under 3 cents each. Oil paint for wood arms is more expensive and cannot be guaranteed over one year.

Because of the saving in weight, shipment of this metal arm can be made at a minimum cost, as the following figures testify:

Weight of wood arms 10-foot, at 41 pounds, with 10 Western Union Pins, 46 pounds; requires 652 arms and pins for minimum carload of 15 tons, which at average freight rate of only 30 cents per 100 pounds or $90 for car, makes each arm with 10 pins cost 13.8 cents.

Weight of 77-inch steel arm, 33 pounds, with 12 pins, 42 pounds or 714 arms to car of 15 tons, which at 30 cents per 100 freight or $90 per car, makes each arm and 12 pins cost 12.6 cents, but as each steel arm, carrying 12 wires against wood arms 10 wires, steel arms have 20 per cent greater capacity, reduces comparative freight cost per arm to 10.1 cent or a saving per arm of 2.7 cents—a saving of 2.7 cents per arm on one million arms is $27,000, an interesting saving to several companies using this quantity of arms and over annually. This saving is based on a 30-cent freight rate, which is a low average.

Vermont Commission News

The Passumpsic Telephone Company of Newport has been granted permission by the Public Service Commission to increase its capital stock to the amount of $14,250. This new stock is to be sold at par and the proceeds to be applied on the purchase of the Citizens' Telephone and Telegraph Company's exchange at St. Johnsbury. The Passumpsic company is under the control of the New England Telephone and Telegraph Company.

Ohio Commission News

The Cranberry Home Telephone Company, which recently made application for permission to establish an exchange at New Washington, has been denied a certificate of public convenience and necessity by the Public Service Commission. The local telephone company expressed itself as being opposed to this move claiming that the people already have good service and that a second system would be detrimental to the present system.

Wabash Adopts Telephone Train Dispatching

Another of the extensive railway systems has taken up selective telephone train dispatching, the Wabash, after its telegraph department has made a full study of the operation of the system upon other roads, having made a beginning with an order for an installation covering fully one-quarter of its lines. The management sometime ago placed an order with the General Railway Equipment Company for the equipment of five circuits aggregating over 600 miles, and the installation of the apparatus is now in progress. The circuits are from Peru to Tilden, 101 miles; from Peru to Montpelier, 105 miles, from Montpelier to Detroit, 97 miles, from Decatur to Chicago, 173 miles, and from Moberly to St. Louis, 148 miles. The equipment is the standard United States Electric Company design of Gill apparatus of the local battery bell type, and the way station equipment includes 146 Gill selector outfits. At the five dispatcher stations there is installed the standard United States Electric No. 29-A dispatcher's signaling set and Gill individual automatic calling key cabinets with spare spaces in each for the addition of stations hereafter. There are three Gill wire chiefs test sets and 50 siding telephones will be installed for the convenience of train crews in communicating with the dispatcher from passing points where there is no train-order station. Each circuit also has a portable telephone set in an iron case which by means of a line pole can establish telephone communication from any point at which a train may be stopped. Each of the way stations is equipped with the General Railway Equipment Company's new transmitter arm and head. This is a japanned jointed iron arm on a desk standard, arranged to swing clear of books and papers which may be on the desk. The radius arm extended has a length of two feet and the mouthpiece may be adjusted anywhere within a full circle from its standard. The transmitter head embraces a novelty in that the cord terminals are accessible by the removal of a single screw and without tools other than a jackknife. Cord renewals are easily made in this box. A head receiver is furnished and this also is of improved design to permit of making connections at the cord terminals from the outside of the receiver and without taking it apart.

Davis Explains Telephone Situation

Representing the Morgan telephone interests in Ohio that are anxious to merge with the Bell interests as quickly as can be done, Frank A. Davis, president of the Columbus Citizens' Telephone Co., spent two hours explaining the telephone situation in the state to the members of the State Public Service Commission, according to a Columbus, Ohio, dispatch.

The conference was significant, in the opinion of those who are interested in the telephone developments in the state. Mr. Davis filed no motion, made no application, made no request of any sort, but confined himself to a detailed story of the conditions that existed at the time the independents were first promoted and the better conditions that exist now as a result of the competition.

Mr. Davis said the good results of competition had been secured by the public, and that it would be financial folly to require two corporations to maintain two sets of expenses all the way through for the privilege of taxing the public twice. He suggested the rational way to handle the situation now was to merge the competing companies; have one company supplying service and save the public the duplicate expense.

That such a situation was the wise and businesslike one to bring about, he argued, because the state now is in a position to force a reasonable service at a reasonable price. In the old days, when there were no independents, there were no such laws, and the old company did as it pleased and established the figure for its service that it chose to select.

Mr. Davis was of the opinion that the better condition now was due wholly to the activity and enterprise and development work of the independents, and held they had performed a real public service. They had taken the telephone, which was a monopoly and a luxury and had destroyed the monopoly and had developed it until it was a necessity now and had brought the necessity within the limit of the small user as well as the larger one. He quoted figures showing that when the independent invaded Columbus, there was one telephone for each 67 voters. Now there is a telephone for each 6 voters in the city, and the number is growing each year.

He expressed the firm conviction that no large merger would take place until there was a public demand for the simplification of the service. He said the Morgan people had no plans for mergers that did not fully protect the interests of the independents at all points in the state.

The conference was sought by Mr. Davis for the purpose, as he expressed it, of making the members of the commission familiar with the situation that had existed, the situation the independents had got greatly changed, and the ideal situation that ought to be and could be brought about.

Automatic for Leeds, England

An order has just been received by the Automatic Electric Company of Chicago through the Automatic Telephone Manufacturing Company, Liverpool, in which company, the Automatic Electric Company is largely interested, for the automatic equipment to be installed in the main exchange at Leeds. This installation is being made for the British postoffice, under whose supervision the telephone system of England is now operated.

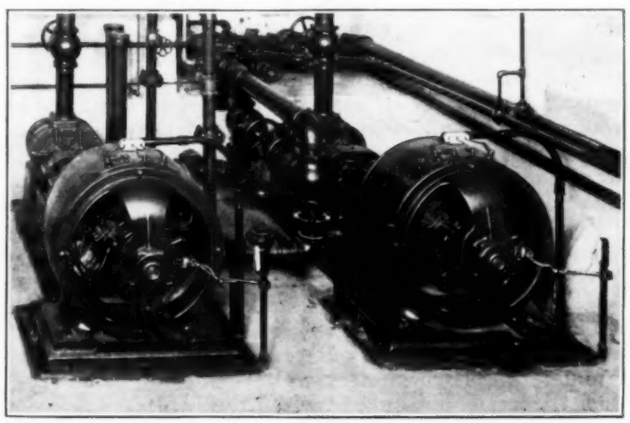
The order provides for 6,800 lines of central office equipment, to be delivered within seven months, and the installation to be completed five months thereafter. This is only a part of the equipment that will be ordered for the Leeds exchange, as it is contemplated to install automatic equipment in the branch exchanges after the main exchange has been cut over to automatic. The total installation after the branch exchanges have been completed will be upward of 10,000 lines.

Specifications covering the equipment to be installed in the main office provide for individual line, party line, measured and zone service. This order was placed after the success of automatic equipment had been thoroughly demonstrated to the British Post Office officials by the successful operation of the installations made at Epsom, England, and in the official headquarters of the General Post Office at London.

The Telephone Scrap Book

Telephone Determines Motor Speed

A NEW labor saving application of the telephone has been made by the Fort Wayne Electric Works, Fort Wayne, Ind. In order to save the time of the engineer, a telephone transmitter is placed with the mouthpiece in close proximity to the brushes and commutators of the motors that drive the auxiliary ma-



Note Telephone Transmitters to Right of Commutators.

chinery of the office building. Each transmitter is connected with plug receptacles on the switchboard, so that a receiver may be plugged into any line at will. This allows the engineer to determine whether motors in the different parts of the building are operating properly without going all over the building to the location of each motor.

The engineer can tell by the pitch of the humming sound made by the brushes passing over the commutator bars what speed the motor is making and whether the brushes are sputtering or chattering. As the pitch increases directly with the increase of speed in the motor, an experienced engineer can control the speed nearly as accurately and as easily as if he were looking at the dial of a speed indicator. The view shown here is that of four direct current motors driving pumps connected with the heating and water system of the main office building, but every motor in the building is connected in the same way.

It is as easy, by this method, to control a fan motor on the roof as it is to start a pump in the basement.

Miniature Telephone Plant Exhibit

THE miniature telephone plant shown in the accompanying illustration was constructed by some of the telephone enthusiasts of the class in applied electricity in the Evening High School, Newark, N. J., says the *Telephone Review*.

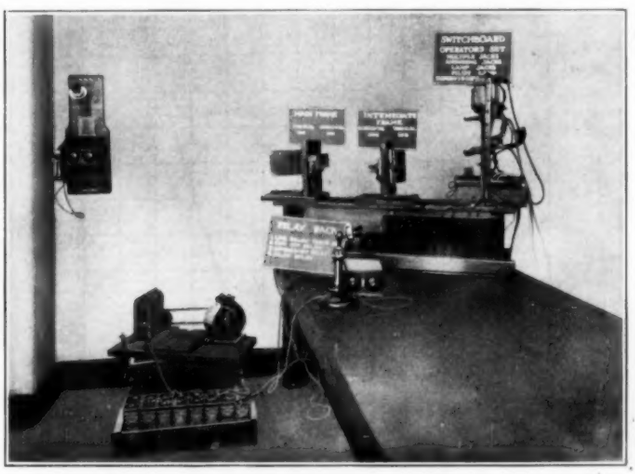
It was exhibited and operated at the recent Industrial Show in that city. The cut shows a complete "A" board, main and intermediate frames, relay rack line and cut off relays, pilot relay, supervisory relays, switchboard, operators' head set, ringing keys, pilot lamps, line lamps, supervisory lamps and terminal box, including a section of cable. All parts used are standard telephone equipment, wired in a neat and workmanlike manner.

The battery consisted of 18 dry cells, and ringing current was furnished by a small motor and 5-bar power generator.

The positive terminals were wired to a metal strip extending along one side of the framework. For ground a similar strip was extended along the other side. The battery was connected to the strips. Two subscriber sets were connected up and were operated during the show by various members of the class.

A large number of the New York telephone employees are taking advantage of this free electrical course, given by the Board of Education of the city.

Two instructors are employed, one a specialist in general theory of physics and electricity now engaged in telephone work, and the other an electrical engineer. The heads of the various electrical companies of the city are interested in this course and encourage their employees to attend. In many cases men owe their advancement to the increased value to the company of their services because of attendance at these classes. I. J. Thorp, division plant superintendent of the telephone company, is keenly alive to the advantages to be derived from such a class and has often expressed his interest. He believes



Miniature Telephone Central Office.

that telephone men will be of greater value to the company if they are well grounded in the foundamentals of electricity.

Properties of Iron at High Frequencies

THE following experimental measurements well undertaken with a view to the possibility of determining beforehand the probable iron losses and the saturation limits in high frequency machines, and also to investigate the uses of iron in the construction of transformers for high frequency currents. The generator used was intended especially for wireless telegraphy and telephony in connection with small antennæ for moderate distances, where the

frequency is higher than with high antennæ. Some novel points were encountered in the construction of the generator.

With a frequency of 100,000, the size of the slot is almost as small as it can possibly be made, if room is to be found for insulation capable of withstanding a working pressure of 110 volts. It was indeed possible to increase the number of slots from 600 to 800, but beyond this there seemed nothing to be done except to increase the speed. The factors of safety seemed to allow of an increase of speed but the question of air friction showed it to be impossible. As much as 5 kilowatts are absorbed in overcoming air friction, set up by a disc of diameter 31 cm., rotating 20,000 times a minute, and it was calculated that an increase of speed would raise this to 15 kilowatts for a frequency of 200,000, which was an impossible figure from the point of view of heating.

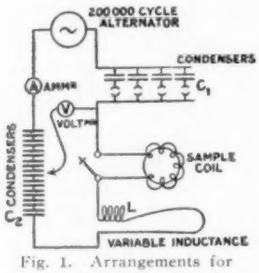


Fig. 1. Arrangements for Measurements.

The generator was therefore, run at the original speed, viz., 20,000 revolutions per minute—one conductor was arranged in each slot, but by a special form of design, the 800 slots produced the same effect as 1200 poles. The voltage on no load was 90.

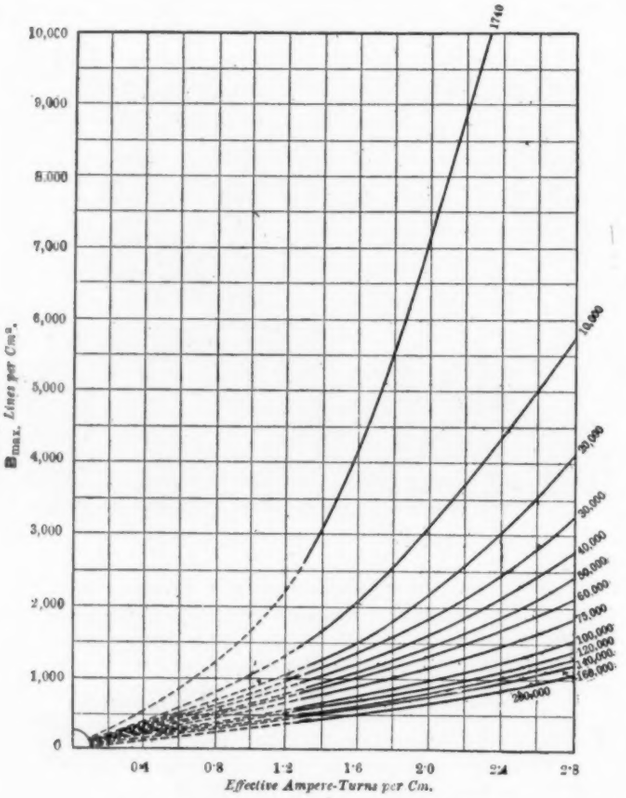


Fig. 2. Alternating Current Saturation Curves.

The main point of the test was to determine the iron losses. The arrangements included the testing coil, a battery of condensers, and a variable self-induction. The ratio of capacity to self induction was altered till the power, measured in volt-amperes, was a minimum, a constant current flowing through the testing coil. This minimum gives the point at which the current just begins to lag.

The iron core is then removed, and the measurements are repeated. This second measurement gives the losses in all of the auxiliary apparatus, and in the connecting wires; the difference between the two readings gives the loss in the iron core. The upper harmonies in the current-wave may produce a certain error, but this may be neutralized by inserting a variable condenser in series with the generator, which is so adjusted in each case that the maximum current flows for any given excitation of the field. In this way the higher harmonics are dumped out, and an approximately sure shaped current results.

The condensers can either be in parallel with the testing coil, in which case the current is a minimum when the final adjustment is made; or they can be in series with the testing coil, in which case the voltage would be adjusted to a minimum. This latter plan was adopted throughout.

The connections are shown in Fig. 1. The testing coil is in series with a battery of condensers, each having a capacity of 1 microfarad, and with a variable self induction, consisting of a thin insulated wire, about 1.5 meters long, which was wound on or off a hollow cylinder of about two centimeters diameter. Ammeters and voltmeters were of the hot wire type, and the resistance used with the voltmeter were shown to be sufficiently free from self induction to cause no appreciable error when used with a frequency of 200,000.

The testing coil consisted of a ring 5.1 centimeters in diameter, containing 10 turns of a thin iron strip, 0.076 mm. in thickness, and 19 mm. broad. The layers of the winding were separated from one another by thin paper. The winding consisted of a silk insulated wire 0.16 mm. in diameter, there being two wires in parallel and 20 turns in series. There were two sets of measurements for the determination of the skin effect and of the iron losses.

The skin effect was determined by noting the apparent permeability of the iron at different frequencies and saturation by measuring the voltage and current at the ends of the testing coil. The iron losses were determined as follows: The generator was run at a constant speed, and the condenser C_1, was so adjusted that the maximum current was obtained from this frequency. The voltmeter connection was then moved along the series of condensers C_2, till that point was reached which seemed to give the minimum voltage correctly. The variable self induction was then adjusted till the exact minimum was reached.

With this adjustment of the circuit, a continuous series of observations was made with a variable field strength in the generator, and the voltage and current in the circuit were ascertained. The testing coil was then short circuited, and new adjustments were made, the volt-interconnection remaining unaltered, but the self-induction was altered until the minimum voltage was again obtained. These readings were taken for various frequencies between 40,000 and 200,000.

In discussing the results it may be said that the apparatus worked well and gave accurate results. But it must be confessed that at first there were difficulties in getting concordant results, until it was found that a

great deal depended on variations of temperature. The skin effect, the apparent permeability and iron losses are all functions of the specific resistance, which depends on the temperature. In order to keep the temperature constant, the testing core was immersed in oil. In

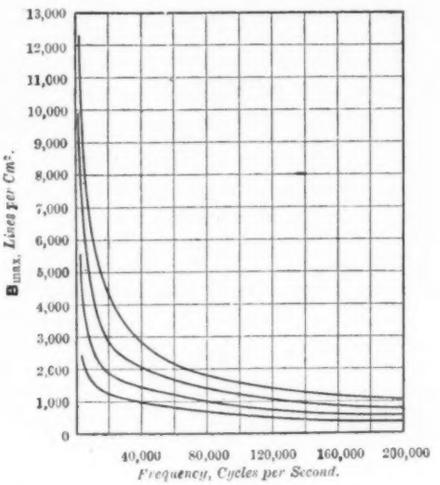


Fig. 3. Apparent Densities at Constant Ampere Turns and Varying Frequency.

spite of this, the heat was not conveyed away as quickly as could be desired.

With the highest saturations and frequencies the iron heated so fast that the apparent permeability might be seen to increase by 20 percent in half a minute when the circuit was closed. A number of corrections were considered, but were of small account. First, there was the resistance of the winding, and then the error introduced by the current taken by the voltmeter. This latter appeared, and amounted to 4 per cent, but was not serious when compared with other errors, which it seemed more important to avoid.

The method finally employed was to make the adjustment very exactly; then to allow the coil a sufficient length of time to cool down, and as soon as it was cool, to take the readings as quickly as possible, closing the circuit only for an instant. Fig. 2 gives the magnetization of the iron in the same form as is

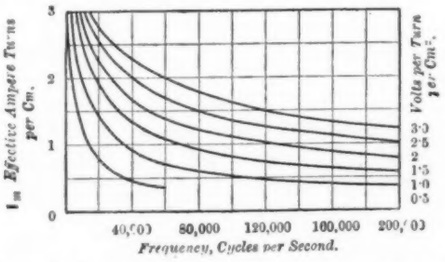


Fig. 4. Magnetizing Current at Constant Volts per Turn and Varying Frequency.

usual with saturation curves for alternating current, a separate curve being given for each frequency.

Fig. 3 shows the decrease of the apparent saturation with increasing frequency; in other words it shows the skin effect. Fig. 4 gives the magnetizing current in the form most convenient for purposes of design. Each curve represents the constant value of the actual voltage which is induced through 1 square centimeter of core area. The curves show that in spite of the skin effect, the requisite magnetizing current for the production of a given voltage steadily decreases with an increase of frequency. Fig. 5 gives the iron losses for a given frequency and variable excitation.

The experiments show that the widely expressed notion that iron cannot accommodate itself to very high frequencies is groundless. It seems that the magnetization of iron can follow a high frequency, and the permeability at a frequency of 200,000 is the same as at 60. It is true that the apparent permeability of the iron in the testing sample at the higher frequency is only one-tenth of what it is at the lower. But this is in complete agreement with theoretical deductions which allow for the skin effect, the true permeability being the same in the two cases.

Applying the Steinmetz formula for the skin effect, according to which the penetration is given by the equation

$$lp = \frac{3570}{\sqrt{\lambda \mu f}}$$

we get the following as mean values for the constants for the testing sample—viz., permeability $\mu = 22.50$

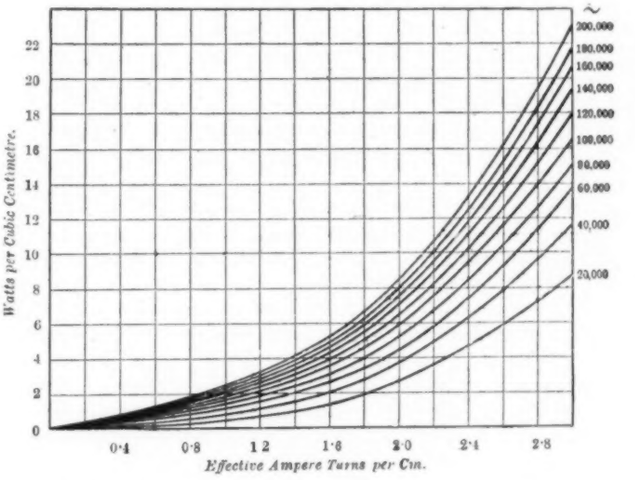


Fig. 5. Iron Losses for Given Frequency and Variable Excitation.

and conductivity $\lambda = 0.9 \times 10^5$. Consequently the penetration at 200,000 frequency is 0.00056 cm. The tests show the mean permeability at low frequency to be 2250, and mean apparent permeability at 200,000 periods to be 180, from which the penetration can be shown to be 0.0003 cm. The difference between the calculated and measured values of the penetration must obviously be due to the fact that the coil had no closed magnetic circuit.

These facts about the behavior of iron at high frequencies are all the more interesting inasmuch as it can be shown that iron can actually do much useful work if used in the construction of high frequency machines.

It can be asserted that without the use of iron in the armature, the construction of a generator for a frequency of 200,000 would be an impossibility. It

is generally supposed that transformers with iron cores for high frequencies are impossible. On the other hand, it is well known that at ordinary frequencies the efficiency is increased and the weight is diminished by increasing the frequency at which the transformer works.

A series of calculations was made on the design of transformers using as a basis the results of tests already described. It might have been expected that it would be found that there is a point at which the usefulness of iron ceases, but it turned out that the ordinary rules apply up to 200,000 periods, and probably further still. The following is the tabulation of these calculations:

DESIGN OF 5-K. W. TRANSFORMER.

Frequency	60	1,740	10,000	50,000	100,000	200,000
Size of core (cms.)	4.65	2.51	2.41	2.14	2.06	2.00
Weight in kilos	19.50	3.05	2.70	1.90	1.70	1.50
Volts per turn and per square cm. of iron	0.04	0.47	0.56	0.92	1.08	1.22
Losses in iron	120	156	92	56	54	52
Ohmic losses	450	70	62.4	44	39	35
Efficiency	90	96	97	98.1	98.2	98.3
Magnet. current per cm.	5	5.6	2.9	1.73	1.5	1.3

In this table a series of transformers are calculated on purely theoretical considerations. Practical matters are left out of account, such as things relating to insulation and capacity. The same conditions apply in all cases to the iron core and the winding space, and the heating is always allowed for on the understanding that 1 square cm. of radiating surface is allowed for 0.156 watt of iron loss. The insulation between the iron plates is supposed to take up 50 per cent of the space occupied by the iron, the current density in the copper being supposed to fill out one-third of the whole of the winding space.

From these calculations it seems that a transformer for a frequency of 200,000 has a surprisingly small weight, and a very high efficiency, while a transformer for a frequency of 60, designed according to the same conditions has a very much lower efficiency, although it weighs twelve times as much. Its weight would have to be seriously increased in order to have the same efficiency. Moreover, the magnetizing current for the higher frequency is much the smaller, amounting only to 1.3 per cent, a figure that would have to be increased by 40 per cent if the iron core were removed.

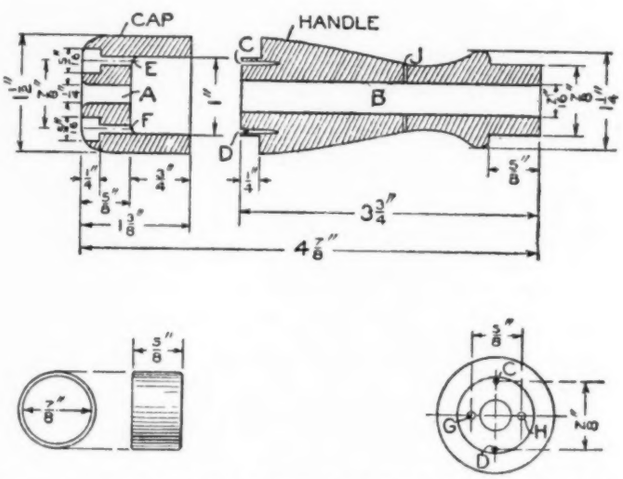
A skin effect is sufficient with sheet iron 0.08 mm. thick to prevent a higher reduction than about 1,200 per square cm., at the highest limit, and in spite of this, calculations show that the use of iron in apparatus of this type would be beneficial.

Making an Electric Soldering Iron

AN efficient electric soldering iron that is easily made by the amateur mechanic is described by R. A. McClure in a recent issue of *Popular Mechanics*. The heat developed in his iron is due to a resistance wrapped about the copper soldering bolt, and requires approximately 90 volts for its successful operation. On a 110 volt circuit the current taken will be approximately 0.82 ampere, the coil resistance being 134 ohms.

Two pieces of well seasoned maple about 10 inches in length and 1¾ inches in diameter are turned to the dimensions shown in Fig. 1, and a hole *A* is drilled for the main wires to pass through. The outside edge of this hole should be rounded off and smoothed to prevent chafing the insulation of the wires. Before drilling hole *B*, an iron or steel tube should be secured, 5 inches in length, with an outside diameter of approximately 7/16 of an inch, and a wall thickness of 1/16 inch, or about No. 16 gauge.

Now drill *B* so that the tube will be a driving fit, taking care that the tube does not fit so tightly as to split the wood handle. A brass ferrule is now made for a drive fit on the small end of the handle as shown by Fig. 2. Preferably this should be made from a brass tube, but it can also be made, if necessary, by making a ring of sheet brass, and soldering the free ends. The two holes, *C* and *D*, are for screws that pass through *E* and *F*, that serve to hold the handle and tap together. *G* and *H* should be drilled to receive two small binding posts that are to serve as terminals for the winding of the heating coil. Two pieces of round brass rod, about 1½ inches long, may be us used for the binding posts, each with one end threaded to fit the thumb nuts of a dry battery. The other end of the rod is sharpened, and driven into the holes *G* and *H* until about ⅜ of an inch of the threaded ends project. Each post is then provided with two small washers and two flat nuts. The hole *J* should not be drilled until the metal tube has been forced into place. The handle is now complete,



Dimensions of the Wood Handle (Fig. 1) and Detail of the Ferrule (Fig. 2) and End (Fig. 3) That Enters the Cap.

and should be sandpapered down and given several coats of shellac. A piece of wrought iron should be turned to the dimensions given in Fig. 8, the narrower opening in this piece being of such size that it will fit very tightly over the end of the metal tube shown in Fig. 5. Force one end of the tube into the opening in the wrought iron piece to a distance of ⅝ inch. Drill two small holes, *A* and *B*, Fig. 4, through both the wrought iron piece and the tube, and put a rivet in each of the holes. Countersink the outer end of the holes, and file down the rivets flush with the surface of the wrought iron piece. The other end of the tube should be driven 2½ inches into the wooden handle.

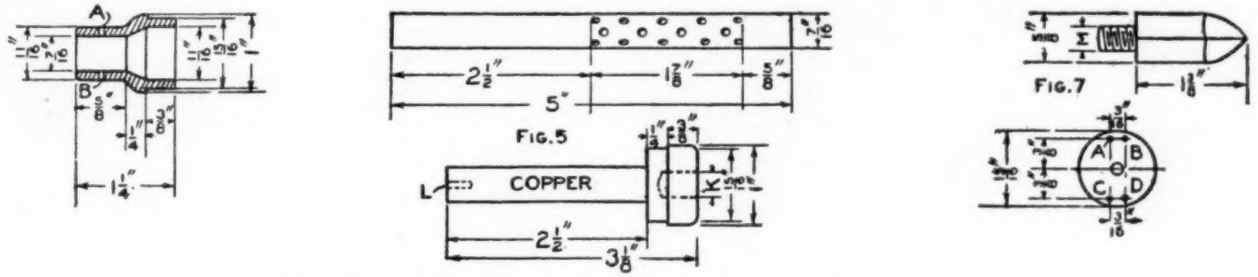
Now drill hole *J*, Fig. 1, and put a pin through it, cutting away a part of the pin inside the tube so it will not obstruct the opening. Drill a number of 1/16 inch holes in the tube as shown in Fig. 5, for ventilation, to prevent an excess of heat from reaching the handle.

Cut a piece as shown in Fig. 6, from a copper bar, with the core 11/16 inch in diameter. This forms the

core for the heating coil. Drill *K*, ⅜ inch in diameter, in the large end and thread. Drill *L* in the other end and thread for a ⅛ inch machine screw. Take a steel tube 3⅜ inches long, with an inside diameter of 15/16 inch, and slip one end over the piece shown in Fig. 4, drilling four small holes through it and the wrought iron piece after assembling. Space these holes equally around the tube, and about 3/16 inch from the end. All the holes should be threaded, and small machine screws provided for them.

Slip the copper core into the other end of the steel tube, and drill four holes in this end, threading them the same as at the other end. The tube should fit tightly on the wrought iron and copper pieces, and the ends should be square against the shoulders when the holes are drilled. The soldering point should now be made as shown in Fig. 7, with the threaded end *M* of such size that it will snugly fit in the opening *K* in the piece shown in Fig. 6. The point itself can of course be made of any shape desired. The point of the iron, and the core, can be made in one piece, which under ordinary conditions will, perhaps, give the best results, as the point cannot become loose, and the transmission of heat is improved accordingly.

insulation will not withstand the heat. These leads should each be about 10 inches in length. Then obtain about 40½ feet of No. 28 gauge bare Superior resistance wire. This is a special kind of resistance wire which at that gauge has a resistance of 3.32 ohms per foot. Another kind of resistance wire known as "Ia Ia" has a resistance of 1.89 ohms per foot for No. 28. If this kind of wire be used, 71 feet will be required. The coil is wound as follows: Pass the end of one of the asbestos-insulated leads back and forth through two of the small holes in the mica washer, that are near each other, a number of times, allowing about 1 inch of free wire to protrude through the washer toward the inner part of the spool. Attach one end of the resistance wire firmly to the end of the terminal wire. Then wrap around the copper core a thin sheet of mica and start winding the resistance wire on. The spacing between the adjacent turns should be approximately equal to twice the diameter of the wire. Do not run the winding nearer the end of the core than ¼ inch. Place a thin sheet of mica between each layer of the winding and continue the winding until the required length of wire has been used. The outside end can be terminated just as the inner end, and the winding is complete. Now place the coil



Detail of the Tube and Parts Connecting the Wood Handle to the Copper Point, and the Copper Core for the Coil.

With the exception of winding the coil the iron is now complete. Cut a washer from some heavy sheet mica about 3/32 or ⅛ inch thick, having an outside diameter of 15/16 inch, and drill a hole in the center so that the small machine screw that is to fit in *L*, Fig. 6, will just pass through it. Drill four other holes, *A*, *B*, *C* and *D*, in the washer as shown in Fig. 8.

Obtain a small metal washer about ⅜ inch in diameter with an opening in it of the same diameter as the opening in the center of the mica washer. Now fasten the mica washer to the end of the copper core with the machine screw, placing the small metal washer between the mica washer and the head of the screw. After the screw has been drawn up tightly drill a small hole through the metal and mica washers, near the edge, and

Fig. 9. The Assembled Electric Soldering Iron Ready for Use.

about ⅜ inch into the copper core. Drive a small brass or copper pin into this hole which will serve to prevent the mica washer from turning around. The object of preventing the mica washer from turning around, is to give a solid anchorage for the terminals of the coil and the leads that are to be carried back through the handle. The leads from the coils to the back end of the handle should be insulated with asbestos as any other kind of inside the metal tube, shoving the leads back through the handle. Fasten the ends of these leads under the binding posts. Procure a piece of lamp cord and an attachment plug, and attach the plug to one end of the cord, passing the other end through the opening *A* in the handle.

Tie a knot in the cord inside the handle, and fasten the ends under the binding posts. Two slender screws at least 2 inches in length should be provided to fasten the handle and cap together. The completed iron will appear as shown in Fig. 9.

Error in Automatic Advertisement

In the advertisement of Automatic Electric Company for February, March and April of this year, the name of New Zealand is included among the countries which have adopted automatic telephone apparatus. This was a mistake which crept into the ad, owing to the fact that the copy was furnished late and the rush incident to the convention of the National Independent Telephone Association, which came on at the time. Due to these causes, the proof was not read and the error was not discovered. It arose from the fact that there were two lists of countries, one in which automatic had been adopted, and the other, countries seriously considering automatic equipment; the name of New Zealand should have been in the latter list.

German Police Portable and Pocket Telephones

THE accompanying illustrations show the construction of some unique portable telephones utilized by the police of various German cities as constructed at Berlin by the Telephone Fabrik Aktien Gesellschaft, formerly J. Berliner.

One of these types of police telephone of the portable type consists of a hand transmitter, the receiver being held in position by elastic bands on the head of the police officer. Another type is so constructed as to hang the transmitter just below the chin so that the hands are free for making notes of orders from headquarters in reporting information to the police station.

German Policeman with Telephone.

A form of pocket telephone has been devised and is largely used by the municipal authorities in Berlin, both the police and fire departments. With the great expansion of the German capital and other large European cities there are many outlying districts which are made unsafe through insufficient policing, but a partial solution of this problem is the adoption of the portable telephone.

German Pocket Police Telephone.

Every police officer is provided with a pocket instrument and can therefore communicate with police headquarters, the fire department or the principal hospitals whenever he finds it desirable. There are contact stations located in the parks and suburban forests and on the poles of the city streets so that the police officers are always in touch with the city authorities.

The contact stations are also located on lamp posts, walls, doors and other convenient places and are made weather proof so that moisture from rainstorms cannot damage them, the entire equipment being thoroughly insulated.

In the business sections of the city of Berlin there are several of these contact stations for every block and it is therefore as easy to telephone as to post a letter at the mail box. The form of pocket telephone is unique and compact, the receiver and transmitter fitting into a nickel case about the size of a watch and but a trifle thicker, weighing only a few ounces.

A similar pocket telephone has been brought out in the United States for common use, designed as a sanitary device so that every person may carry his own telephone transmitter and receiver is he desires.

Mississippi Convention

The fifth annual session of the Independent Telephone Association of the states of Mississippi, Alabama and Tennessee convened in Meriden, Miss., in the parlors of the Great Southern Hotel with fully seventy-five representatives present.

Numerous supply houses showing a lot of instruments, were represented at the meeting and the supplies were on exhibit at the Great Southern hotel during the entire convention.

Among those present were: J. B. B. Wilkinson, Louisville, Ky.; W. H. Bryant, Mobile; W. F. Hamilton, Chicago; J. B. Shannon, New Albany, W. M. Ange, Jr., Corinth; M. L. Shannon, Pontotoc; Jno. P. Caldwell, Sherman; H. J. Newbill, Tupelo; L. L. Conway, New Orleans; F. A. Roder, Chicago; J. E. Cunningham, Aberdeen; A. A. Overstreet, DeKalb; J. C. Kelsey and wife, Chicago; M. P. Derdei, Yazoo City; Solomon Levy, New Orleans; J. R. Bailey, Jackson; D. E. Hughes, Obediah; J. A. Miller, Fruitdale; F. M. Hodgson, Chicago; H. P. Blac, Hattiesburg, and J. C. McCarthy, Guntown, Miss.

The association is composed of the independent telephone companies of Mississippi, Tennessee and Alabama.

W. H. Bryant delivered an interesting talk on conditions in Alabama. He discussed particularly the purchase of independent telephone plants and the steps taken to prevent the consummation of the sales to the Bell telephone company.

J. R. Bailey, of Jackson, discussed the general conduct of the telephone business, collections and also the necessity of a better mutual understanding.

Sidney White, of Kosciusko, brought out the position of the Postal Telegraph Company's attitude. It was the belief of the convention that the Postal had no sincere attitude toward the independent telephone interests.

The convention was in session two days. The members tried to analyze closely the attitude of the state railroad commission toward the independents. The convention believed that the commission was rather partial to the Cumberland system in the matter of taxation.

J. C. Kelsey, of Chicago, made a strong speech on co-operation of independent telephone associations throughout the United States.

Great Northern Extends Train Dispatching

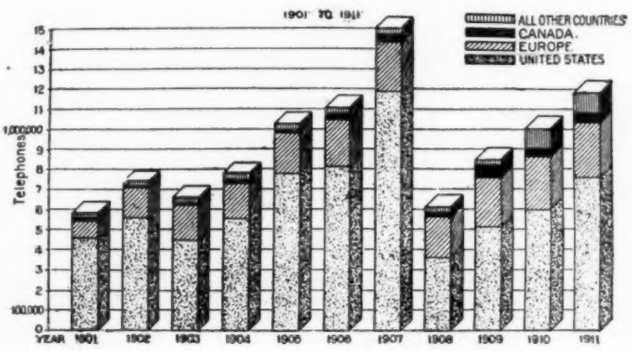
The Great Northern Railroad, which is already operating a large amount of tracks by the telephone, has recently purchased from the Western Electric Company 34 selectors to equip another division. This circuit will extend from Vancouver, British Columbia, to Seattle, Wash., and the dispatcher will be located at Delta, Wash. This circuit will be 129 miles in length and will bring the total mileage of tracks operated by the telephone up to over 4000.

Telephone Statistics of the World

Compiled by Statistician, A. T. & T. Co.

1. CONDITION JANUARY 1, 1912, AND PROGRESS DURING 1911.

THERE were approximately 12,453,000 telephones and 29,566,000 miles of telephone wire in use in the world January 1, 1912. Compared with January 1, 1911, this is an increase of 10 per cent in telephones

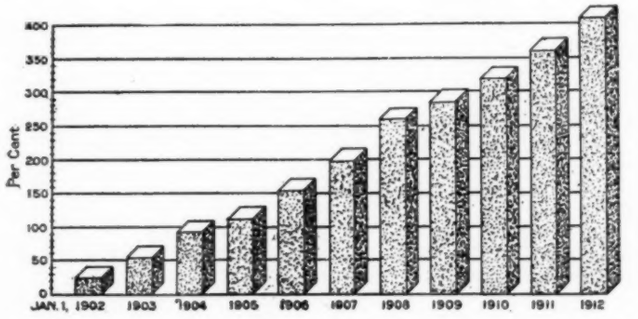


The Annual Increases in Telephones of the World, Divided by Countries, 1901 to 1911.

and 9 per cent in wire. A careful estimate places the world's telephone investment January 1, 1912, at about $1,729,000,000, which is very nearly the value of all gold coin and bullion in the United States. The annual number of telephone conversations may be placed at 22,000,000,000, which is about five times the annual number of passengers carried by all the railroads of the world.

For the purpose of this compilation the world's telephone statistics are generally tabulated in four territorial divisions, as follows:

	Telephone Jan. 1, 1912			Wire Jan. 1, 1912		
	Number (partly estimated)	Increase over Jan. 1 1911	% to Total	Miles (partly estimated)	Increase over Jan. 1, 1911	% to Total
United States.....	8,362,000	10%	67.1%	18,179,000	9%	61.5%
Canada	335,000	18%	2.7%	788,000	11%	2.6%
Europe	3,239,000	9%	26.0%	9,461,000	8%	32.0%
All other countries...	517,000	21%	4.2%	1,138,000	32%	3.9%
Total 12,453,000		10%	100.0%	29,566,000	9%	100.0%



Percentage Increases over Jan. 1, 1901, in Telephones of the World, Jan. 1, 1902, to Jan. 1, 1912.

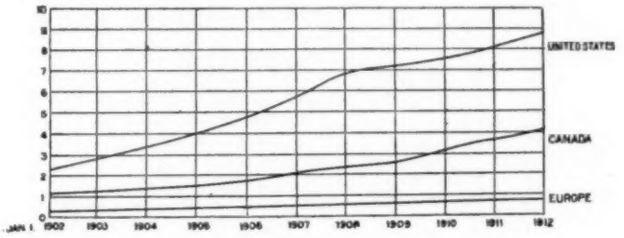
The geographical distribution of telephones and wire is as follows:

	Number of Telephones (Partly Estimated)			Miles of Wire Partly Estimated)		
	Jan. 1, 1912	Jan. 1, 1911	Increase	Jan. 1, 1912	Jan. 1, 1911	Increase
No. America.	8,729,000	7,907,000	822,000	19,037,000	17,401,000	1,636,000
So. America.	120,000	86,000	34,000	233,000	137,000	96,000
Europe	3,239,000	2,966,000	273,000	9,461,000	8,762,000	699,000
Asia	166,000	149,000	17,000	358,000	288,000	70,000
Africa	41,000	34,000	7,000	144,000	128,000	16,000
Australasia..	124,000	110,000	14,000	265,000	212,000	53,000
Oceanica ...	17,000	8,000	9,000	43,000	15,000	28,000
West Indies.	17,000	12,000	5,000	25,000	19,000	6,000
Total 12,453,000		11,272,000	1,181,000	29,566,000	26,962,000	2,604,000

The year 1911 is the thirty-fifth since the invention of the telephone by Prof. Alexander Graham Bell. A survey of the progress of telephone service during the past year, and of the many notable events in connection with this progress, justifies the statement that all civilized nations have awakened to the value of the telephone in commercial and social life.

2. GROWTH DURING PAST TEN YEARS.

The two charts below show the annual increases in telephones of the world from 1901 to 1911 inclusive. The first represents the actual increases and shows that during 1911 the increase was more than twice that during 1901. It also appears that during 1910 the annual increase in telephones of the world again reached the million mark. The second represents, at the beginning of each year, the percentage increase over January 1, 1901.



Telephones per 100 Population, United States, Canada and Europe, 1902 to 1912.

While the telephone business has been increasing constantly, two decided periods of retarded telephone progress are noticeable, especially so for the United States. The first commences with the year 1903, and the second —and by far the greater—with the year 1908. This retardation of telephone progress, particularly in the United States, was caused by the general depressed financial condition of the country, which is evidenced by the following facts:

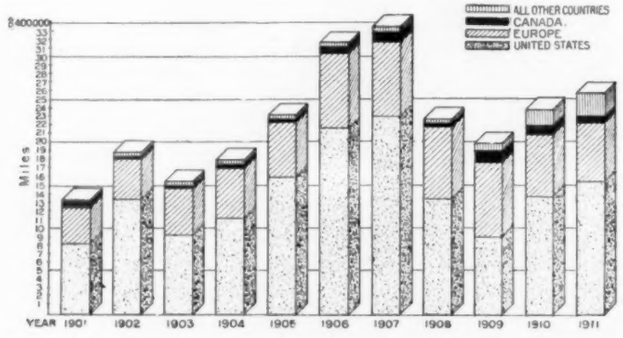
Comparing the years 1907 and 1908, the gross earnings of ten of the leading United States railroads decreased $88,500,000; the building and real estate returns $95,000,000; and the total bank clearings, which in 1906 were $160,000,000,000, had declined to $132,000,000,000 in 1908. Furthermore, liabilities of failures, which in 1906 were $123,000,000, more than doubled during 1907 and were $259,000,000 in 1908.

Considering telephones per 100 population and referring only to the United States, Canada and Europe, the following chart shows their respective condition dur-

ing the past ten years. At the beginning and end of the period the exact figures are:

	United States	Canada	Europe
Jan. 1, 1902.....	2.3	1.2	0.3
Jan. 1, 1912.....	8.8	4.2	0.7

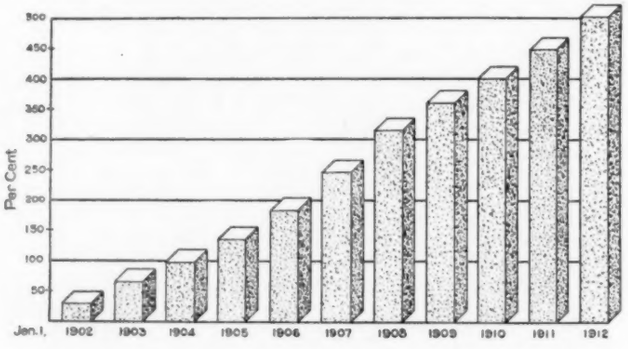
From this it appears that it takes Europe about two years to advance 0.1. Assuming that European tele-



Annual Increases of Telephone Wire Mileage of the World, Divided by Countries, 1901 to 1911.

phone progress continues at this rate, to reach the present development of the United States (8.8), Europe must gain 8.1, which at the rate of 0.1 every two years would require 162 years. As such a forecast makes no allowance for the impetus in future progress due to the use of rates better adapted to the needs of the public and important advances in the art, the above period will be shortened materially. One thing, however, is certain: Europe offers yet a vast field for telephone progress, because at the beginning of 1912 it has reached only the development of the United States January 1, 1898.

The two charts shown relating to the increase in the telephone wire mileage of the world permit a comparison between the latter and the increase in stations, covering likewise a period of eleven years. January 1, 1901, the total telephone wire mileage of the world was about five million miles; at the end of the period (January 1, 1912) it amounted to over twenty-nine million miles, an increase of 500 per cent. On the other hand, the increase



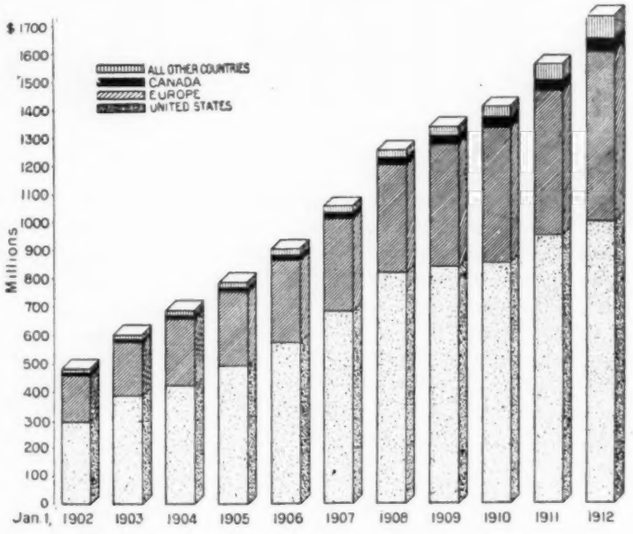
Percentage Increases over Jan. 1, 1901, in Telephone Wire Mileage of the World, Jan. 1, 1902, to Jan. 1, 1912.

in telephone stations during the same period was about 400 per cent.

Referring to the chart shown representing the actual annual increases in wire mileage, we find that the increase during 1911 was twice that of 1901. The lowest annual increase occurs during the year 1901.

It is worthy of note that the United States, January 1, 1912, had over one-half the total telephone wire of the world, and nearly twice the total mileage of Europe, while the latter at the same date had almost the same telephone wire mileage as the United States had at January 1, 1907. The pronounced increase in the wire mileage of "all other countries" is largely due to more accurate information.

The chart below depicts the total estimated telephone investment of the world, sub-divided according to territorial divisions at January 1st of each year from 1902 to 1912 inclusive. During this period the world's investment almost quadrupled, increasing from $482,000,000 to $1,729,000,000. Over one-half of this enormous increase was in the United States, where the annual increase averaged approximately $66,000,000. This was about $27,000,000 more than the corresponding average increase in Europe. At the commencement of the year 1912 the total estimated investment in the United States ($1,025,000,000) was about twice that in all Europe ($593,000,000) and was over one-half the investment of the whole world. At the same date Canada is



Distribution of Telephone Investment of the World, Jan. 1, 1902, to Jan. 1, 1912.

estimated to have $44,000,000 invested in telephones and "all other countries" $67,000,000.

The following chart depicts the telephone conversations of the world for the years 1901 to 1911 inclusive, for the United States, Europe, and all other countries, and shows the proportion of each to total.

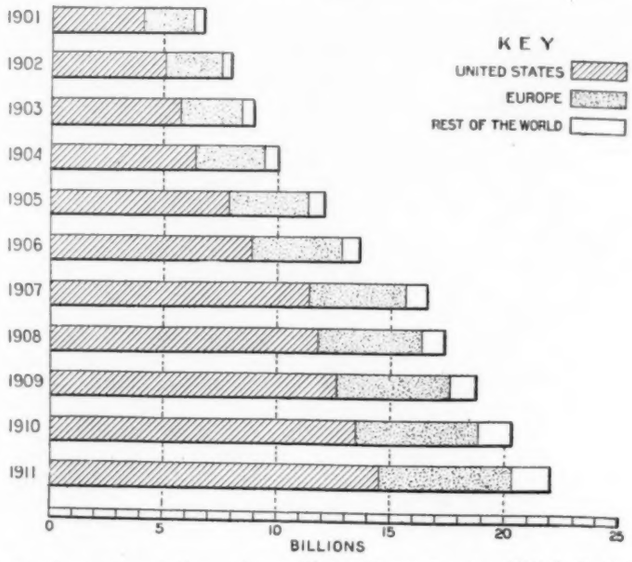
The use which the world made of the telephone in 1911 is illustrated in the subjoined table showing the distribution of conversations for the four divisions:

Division	No. of Conversations during 1911 (estimated)	Increase over 1910	Per cent of Total
United States	14,500,000,000	7%	66.0
Canada	900,000,000	18%	4.0
Europe	5,000,000,000	8%	26.4
All other countries.....	800,000,000	20%	3.6
Total	22,000,000,000	8%	100.0

The combined number of telephone conversations of the rest of the world is but one-half that of the United States. The telegraph traffic of the United States presents quite a contrast. Placing the world's telegraph traffic during 1910 at about 579,000,000, the United

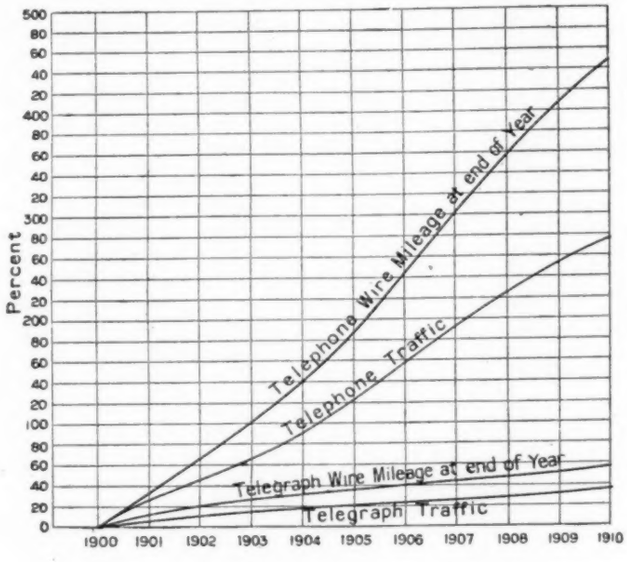
States took but 17 per cent of the total, while Europe had 62 per cent. In other words, Europe has about the same proportion of the world's telegraph traffic as the United States has of the world's telephone traffic.

Going back to the first authentic publication of tele-



Telephone Conversations of the World, Comparing the United States, Europe and the Rest of the World, 1901 to 1911, Inclusive.

phone traffic in the United States (1883) the total number of telephone conversations was estimated to be 217,000,000. During the intervening twenty-eight years the United States traffic has reached, as shown above, the colossal total of over fourteen billion, an increase of



NOTE: Growth expressed as a percentage increase over the 1900 figures.

The Growth of Telephone and Telegraph Traffic and Wire Mileage Compared of the World.

6,500 per cent, or an average annual increase of 232 per cent.

The annual increases, both in the telephone and telegraph traffic and in the wire plant of the world are shown on the last diagram, covering the period 1900-1910. The curves represent the percentage increases over the traffic during 1900 and mileages at the end of the year 1900.

Referring first to the traffic curves, the telephone has gained 277 per cent and the telegraph 36 per cent. In other words the percentage increase in telephone traffic is about eight times that in telegraph traffic. During the same period the increase in wire plant was 448 per cent for the telephone as compared with 57 per cent for the telegraph, so that the percentage increase in telephone wire is also approximately eight times that of telegraph wire.

(To be continued.)

Rate Suit in Denver

The contention of the Mountain States Telephone and Telegraph Company that its rates may not be renewed by anybody other than the state legislature is not based upon a sound principle, according to a decision of District Judge Teller. In all cases where a utility corporation seeks suddenly to raise its rates without apparent reason, the court ruled, the corporation's action may be reviewed. It is to be supposed the court held that where one rate has been in force for considerable time, that rate is reasonable and fair. Judge Teller's decision was given in connection with the suit brought by the John McDonald Security Company and others of the Denver Business Men's Association to enjoin the telephone company from canceling the flat rate contract under which subscribers receive service for $120 regardless of the number of calls. Under Judge Teller's ruling, the suit will now go to trial on its merits. The complaint charges that the abolition of the $10 rate was for the purpose of substituting measured service at a higher cost and that discrimination is made in favor of the Denver Dry Goods Company and the Daniels & Fisher Stores Company, which it alleges are receiving flat rate service for $7 a month.

Michigan Mutual Companies Cannot Sell

The Michigan Supreme Court, in an opinion handed down July 23, held that a telephone company organized for services between its members, but not for profit and unincorporated, has no right to sell out its business, despite the fact that a majority of the stockholders so vote. The decision was handed down in the case of the minority stockholders of a farmers' mutual telephone company of Waldron, Hillsdale county, against the Hillsdale County Telephone Company. It appears that the Waldron telephone exchange was organized some years ago, and had about 175 farmers and subscribers. The company was never incorporated and was not operated for profit. Recently a majority of its members decided to sell out to the Hillsdale County Telephone Company, but a few of its stockholders objected. They took their grievances to the Circuit Court and were ruled against, but won in the Supreme Court. The Hillsdale County Telephone Company, which made the purchase, is not only beaten but the Supreme Court holds it shall pay the costs of the suits in both courts.

Digest of Foreign Telephone Literature

Translated for Our Readers

A SPEAKING METALLIC FILAMENT LAMP.

A VERY interesting phenomenon was recently observed by two German scientists, who were experimenting with electric lamps. Working with a high candle power electric filament lamp, they found that the lamp could be made to emit sounds of speech, if an electric telephone current was sent through the lamp. A high tension microphone and a five-cell storage battery were placed into the primary circuit of a microphone transformer. The feed current of the battery was equal to about 400 milliamperes. The secondary coil of this transformer was connected to the poles of a high candle power lamp by way of a 2 microfarad condenser. The lamp was a 100 candle power Osram lamp, fed by direct current.

If some one spoke into the microphone, and the second person pressed the ear against the electric lamp, the words were distinctly understood through the medium of the lamp. It was not even necessary to press the ear to the lamp, for the sounds could be heard when the listener approached it.

This is not a case of the Preece thermo-telephone, for the lamp bulb contains a vacuum, and the temperature changes of the wires in the lamp cannot transform the surrounding air into vibrations, since there is practically no air. It is probable that the metallic filament is influenced by the temperature changes which it experiences through the passing of the electric current, and communicates these vibrations or changes to the thin glass of the lamp, which in its turn causes the vibrations in the air surrounding the lamp. Trials with a low candle power lamp (16 or 32 candle power) did not give any results in this direction, since the glass is thicker and the temperature variations are too slight. It is very likely, however, that a 500 or 1,000 candle power lamp with exceptionally thin glass would give even better results than the lamp with which the above tests were made.—*Physikalische Zeitschrift.*

PUPIN OR KRARUP TELEPHONE CABLES.

The question whether the long distance distribution of underground cables should be confined to the Pupin or the Krarup cables has been discussed extensively within recent years, without leading to any definite conclusion. There are several advantages to the two methods to increase the self induction of telephone cables, namely, the use of induction coils at various distances in the telephone line, and winding layers of soft iron wire around the copper conductors. At the same time there are drawbacks to both methods, and up to the present telephone men are not clear which of the methods is better in the long run.

A short historical review of the two types of cables may not be out of place, before going into the discussion of the relative merits. The first telephone cables with increased self induction used in actual practice, equipped by Professor Pupin, were laid in 1899. In 1902 a 20-mile cable was laid between Berlin and Potsdam, having 28 pair of copper conductors. The excellent results achieved with this cable led to an extension of several lengths of cable, so that the next year a distance of 262 miles was covered by the Pupin cables, which was unheard of to that time, since the best telephone cable of the older construction did not work satisfactorily at a distance greater than 79 miles. Up to this time these cables were used for underground use only, since the technical difficulties in using them for submarine construction were so great, that they were virtually unsurmountable at the time. In 1901 the Danish engineer Krarup proposed winding soft iron wire coils around his copper conductors, and this was so much simpler than the introduction of the Pupin coils that it was adopted without hesitation for submarine cable work. During the season 1901-02 extensive tests were made with the Krarup cables, and the results were so satisfactory, that it was adopted in many European telephone systems as the standard underground and submarine cable. It was 20 per cent cheaper than the regular type of cable, and was much superior. For several years Krarup cables were the only ones used in European practice for submarine work, and it is a fact that they are giving great satisfaction even at the present time, after more than ten years of continuous service. The 51.5-mile cable between Cuxhaven and Heligoland is perhaps the best example for this statement, and it is said that its perfect working has not been surpassed by any other submarine telephone cable in the world as regards the specific damping effect of β=0.0065.

In 1906 the first test was made with Pupin coils for submarine cables, the Bodensee in the Alps being selected for this purpose. Although the results were very satisfactory in every way, and though they demonstrated the value of the Pupin telephone cable, nevertheless it was proved at the same time, that there are very complicated questions involved in the use of Pupin coils and cables in submarine telephone construction, and that the success of the Pupin cable depends upon a good many factors, which must be carefully considered before adopting this cable as standard. It was argued that the distance of this trial cable was too short to form any final judgment on its value since any other ordinary telephone cable would probably have given the same good service. Some engineers argued that the different characteristics of the several cables connected to form the entire line would have quite an influence upon the ultimate value of the line, and that the introduction of the Pupin coils would have a great effect upon the characteristic of the line in question. The length of the sound waves transmitted by such lines are much shorter than those in the usual cables, and the result is that if telephone currents are sent from the Pupin cable into the ordinary cable there will be reflection losses, and losses in energy, that will be serious, if occurring in long service conditions. These reasons led European authorities to shun the Pupin cable for some time, at least for short distance work, and to favor the use of the Krarup cable for both submarine and underground work. The cables through the Simplon and

Arlberg tunnel in Switzerland, and especially in inter-urban telephone lines were confined to the Krarup type. One of the most interesting types of this kind are the cables used by the Austrian state telephone and telegraph departments, which use several coils of iron wire around their copper conductors, and thus gain an exceedingly high coefficient of self induction.

For long distances the Pupin cable showed such good characteristics, however, that its use for that purpose became more and more pronounced. America set the pace for this use, and started the ball rolling by equipping a 93.2-mile line between New York and Philadelphia in 1906 with Pupin cables. Later these lines were extended to lengths of 233 and 242 miles and more, and the last year to even longer distances. Europe has also begun the more extensive use of the Pupin cable, and the German government is now considering a plan to connect the cities of Berlin, Cologne, and intermediate cities, a distance of 273.4 miles with Pupin cables.

As regards submarine cables, it is necessary to mention the submarine cable between England and France through the English channel, a distance of 24.8 miles and the completion of the cable between England and Belgium, a distance of 55.3 miles. It may be taken for granted that the construction of these cables is familiar to the readers, for the periodical literature has contained frequent reference to the same.

In spite of the excellent results obtained in submarine cables through the use of Pupin coils, the question is not decided as to the ultimate decision in favor of this cable. As proof of this statement, the recent agreement of the French and English telephone companies may be cited, in which a new submarine telephone cable to be laid through the channel between London and Paris is to be laid with a Krarup cable and not the Pupin cable. The reasons advanced by the French department for this decision may be summed up as follows: Although the introduction of Pupin coils into telephone cables has given excellent service, it is true at the same time that the danger of insulation faults at those points at which induction coils are joined to telephone cable, is very great, and that any necessary repairs to the cable at these points would be more expensive and troublesome than similar repairs to Krarup cables. The very fact that the distance between the different induction coils must always be the same, makes the repair work very difficult. In addition, there is the question whether the self inductance of the Pupinized cables will always be the same after many years of service, a point which has not been entirely cleared up at the present time. If this self induction changes, it would be necessary to exchange the Pupin coils frequently, which is an added expense. To prevent any injurious effect of the magnetism of the induction coils, it would be necessary to confine the currents sent through the cable to 60 milliamperes, a rather difficult problem at times. For all these reasons the French government decided to use the Krarup cable, in spite of the fact that the original cost would be higher than that for a Pupin cable.

In order to judge how far Pupin and Krarup cables can compete, it is essential to find the best coefficient of self induction of which both types are capable. It would lead too far to go into the theoretical details of this question, which can, moreover, be studied in any reference work on telephone cables, and it may be sufficient to say that the Pupin cable has some advantages in this respect over the Krarup cable. The use of iron wire coils can increase the self inductance of the copper conductors by only 10-20 millihenry, and even this increase results in many difficulties if heavy copper conductors are employed. For practical purposes this is not enough, however, and the Pupin cable is much more satisfactory in this respect. There is another difficulty in the use of the Krarup cable, which grows out of the employment of the iron wire. The capacity is increased, and the cost of material for guttapercha insulation is much greater than with the ordinary cable. This is not the greatest drawback, however, for the efficiency of the Krarup cable is decreased by the fact that the iron winding leads to a greater effective resistance through increased hysteresis and eddy-current losses. It is of course possible to employ correspondingly fine iron wire for winding, and thus decrease these losses to a minimum, but even at that rate, the losses are considerably higher than in the Pupin cables, and the production cost for the cables increases to a large extent.

The conveying of spoken words over the Krarup cable can therefore not be said to be perfect and is strongly influenced by the above factors. This is just as true, however, of Pupin cables, since it is not true as is often contended by telephone men that the telephone currents are uniformly changed by the Pupin coils, and are uniformly dampened. Devaux-Charbonnel in 1910 found to his surprise, when testing the Pupin cable between England and France, that the telephone currents and sounds spoken through the line were much more distorted than similar sounds spoken through the the ordinary telephone cable. He found that with increased frequency, the specific damping effect in Pupin cables changed to a great extent, influencing the clearness of communicated sound very much. It was observed that telephone currents of the 7,000 frequency, the cable being 194.4 miles long, were subjected to a damping effect which was nine times as strong as currents of the 3,000 frequency, and four times a strong as those of 5,000 frequency. In this respect the conditions are much more favorable in the older telephone cable and the paper insulated cable. Of course if the length of the Pupin cable is kept within 25 miles, this drawback need not be considered, but where such a cable is considered for long distances, especially in submarine work, it should be carefully considered.

The characteristic of the different telephone lines to be connected should also be carefully considered. Most of the ordinary telephone lines have a much lower characteristic factor than the special cables, like Pupin or Krarup cables and if there is a connection between the ordinary aerial line and the underground or submarine Pupin cable, there is bound to be trouble, unless special precautions are taken. Their characteristics are so different that there will be reflection losses, which will weaken the sounds transmitted and make communication difficult. Usually a cable with a characteristic frequency of 400 to 600, will be sufficient for shorter distances, and while it is possible to obtain Pupin cables of this type by using few Pupin coils of low inductance, it is nevertheless true that under these conditions the Krarup cable will be the better of the two. It has been

possible to reduce the size of the Pupin coils to a convenient form, but even at that rate, the introduction of the same in interurban lines at various intervals is connected with a good deal of trouble and expense and speaks more in favor of the Krarup cable. It will also be very difficult to retain the uniform distance between the different coils, and the possibility of later expansion and changes in service lines would make the introduction of Pupin cables a very difficult matter.

While it is true that from the efficiency side of communication, the Pupin cable is in many respects below that of the Krarup cable, it must also be admitted that from the economical side the affairs lie somewhat different. It is true that under similar conditions, with the same efficiency, the Krarup cable is more expensive than the Pupin cable. The winding of soft iron wire around the copper conductors is somewhat expensive, and the necessary increased diameter of the copper conductors is an added expense, since it is necessary to have increased quantities of insulation for the conductors. If the distances to be laid are small, and the number of lines not very large, the difference in cost between the two types is not very great, and the adoption of the Krarup cable is advisable. It is true that the Krarup cable allows more certain results as regards efficiency and losses, etc., than the Pupin cable, where many of these questions depend on factors that are not always within the control of the telephone man. It is also true that the repair and maintenance of the Krarup cable is simpler and less costly than that of the Pupin cable. If a cable is to be laid for long distance, however, the case is entirely different, and the difference in cost is so great, that the Pupin cable stands forth as the superior type. Underground cables for about 31 miles with 50-100 conductors would be laid with Pupin cables, and submarine cables of 62 miles length or more should not use Krarup cables under any consideration. Recent tests in the Siemens Brothers works in England have led to an improvement in construction of Pupin cables, in which the dielectric losses have been reduced to one-tenth of the former value, thus increasing the efficiency of that type of cable. Since the dielectric losses are much lower, the distortion in transmission of spoken sound is much lower, and communication has been exceptionally good with these new types. This splendid effect was obtained by introducing a set of induction coils for every mile of cable, having a self inductance factor of 0.1 Henry. The capacity of these coils was about 0.004 Microfarads.

The results obtained with this improved Pupin cable have made it more of a favorite than ever, and it is doubtful whether the Krarup cable can displace the Pupin cable for long distances, unless such great improvements are made in its construction, that it can surpass the successes obtained with the former type of telephone cable, especially for long distance work.—*Elektrotechnik und Maschinenbau.*

STANDARD FOR OVERHEAD LINE MATERIAL.

A very interesting question was opened in a recent article by a German telephone engineer, concerning the introduction of standard measurements for overhead line material. Most industries have established standards, and we have standard screw-threads, standard gauges for railways, and other results of standardization, that make it possible to produce the necessary materials for construction at a minimum cost, and reduce the labor on the part of the engineer by more than one-half. Strange to say the material for overhead lines has not as yet followed this trend of standardization, and the following article is therefore of considerable interest. It refers of course to European methods, but is of great interest nevertheless.

No material of construction is more subject to influences of climate, weather, atmospheric changes and other factors than the wires used for overhead transmission of electric current, whether it be high tension for power, or low voltage for telephone and telegraph service. The conditions in different localities vary so much that it is impossible to combine all the elements necessary for a material in one metal and say that this meets all requirements and may be considered the standard wire for overhead work. The German wire manufacturers may carry four types of wire in stock, which will suit German conditions, and may have to carry four different types in stock to suit conditions in Switzerland. Most European factories carry at least twelve different types of wire to meet the demand of the buyers, and find that even then they often meet requests which they cannot fill. It was found that one and the same telephone company placed orders for copper wire for its lines which differed in conductivity, tensile strength, torsional strength, elastic limit, and required a different factor for each order, necessitating the construction of twelve different types of wire to fill this one order. This is no exceptional case, but is the rule for most wire selling firms. The Allgemeine Elektricitäts Geselschaft, probably the largest consumer and producer in electrical construction material in Europe has had considerable experience in this respect and its trials and results will be discussed in the following paragraphs.

This company made very extensive tests with line material, especially with copper wire, but with all other metals that would come in question in any way in line construction. Much of this material was thrown aside as either too expensive or else not fit for general use or, for some other reason, till finally the number of metals for use in line wires had dwindled down to a very small factor. It was impossible to find some standard that would allow its use to determine the quality for all materials. Alloying the copper, which was tried in the effort to reduce the expense of wire production led in most cases to a reduction of electric conductivity, so that the pure electrolytic copper remained in the end the only wire that gave the highest co-efficient for electric conductivity. While alloying of copper increased the strength and resistance considerably, it was found at the same time, that this increase was not sufficient to offset the loss in conductivity suffered by the wire due to the alloy. In addition it was found that elasticity and tensile strength usually worked against each other, so that one eliminated the good effects of the other for certain purposes. The physico-chemical influences of alloys on copper for wires may be summed up in the following rules: 1. More or less powerful purifying of the structure, as for example reducing the copper oxide; 2. More or less limited solubility and formation of mixed crystals, i. e., form-

ing a homogenous mixture; 3. Resulting chemical compounds, forming a eutectic mixture.

As soon as the copper and alloy metal enter into chemical combination, the maximum effective use of the copper for electric conductivity is usually passed on the downward curve. Various experiments point to the conclusion that alloys with heterogenous structure are next to useless for electric conductors. This is the most important point for the metallurgist, for the greater the influence of the alloy upon the strength and resistance of the wire, the poorer will be the final effect when used for electric conductors.

The telephone engineer who has to do with the completed product, however, cannot enter into these metallurgical questions, and needs some standard with which to judge the wire placed at his disposal. Practical experience has eliminated most metals except those whose chief constituent is either iron, copper or aluminum as a basic metal. Instinctively the telephone man asks, aside from the cost of the wire, for its specific resistance, its tensile strength, and its specific gravity. It would be better perhaps to inquire for the co-efficient of elasticity instead of the tensile strength. As long as the determination of this factor is so difficult, however, it will be necessary to adhere to the tensile strength requirement. There may be perhaps some point to this, since it has been found in investigations that the relation between the elastic limit and the tensile strength is fairly constant, usually 0.6. The specific gravity offers very crude values of comparison for the different conductors whose weights differ so much in every respect. Nevertheless it offers some point in the so-called breaking length of the wire which is equal to the $\frac{\text{tensile strength}}{\text{specific gravity}}$ and thus allows the computation of the number of poles and their height needed for the line. If the more common metals were placed in a table we would have:

Hard copper wire	with about 95%	conductivity.
Bronze A wire	with about 70%	conductivity.
Spree-aluminum	with about 50%	conductivity.
Bronze B wire	with about 30%	conductivity.

as the four metals that are absolutely necessary for the lineman.

The last point to be discussed in this matter of standard is that of standard diameter for the wire. Copper wire is the only one so far that has any established standard cross section tables. If other wires are used, the line must be computed in long wearisome calculations, often leading to incorrect results. Some of the German government telephone officials have solved the question to their own satisfaction by using very heavy wires for all of the telephone lines, regardless of expense, using for ordinary lines, wire of 3/16-inch cross section. The Verband Deutscher Elektrotechniker has established standards wherein telephone wires should run from 3/64 to 9/64-inch and not thicker for copper, with similar arrangements for aluminum wire, with the additional requirement that no aluminum wire below 7/64-inch diameter may be used in any telephone or telegraph line. The only metals considered standard for wires are copper, bronze A and B and hard aluminum wire. The breaking strength and resistance has been similarly determined for these wires. It is the question however, whether these standards are the best under present conditions, and the complaint is made by many telephone men that the cross sections for cables are too high, increasing the cost consequently to an unnecessarily large figure, while the cross sections for the ordinary finer wires are too low for safety. All indications point to the conclusion that it is time to appoint a commission to look into the establishment of uniform standards for overhead line material, not only in the metals included in present standards, but in those metals that are not used so commonly, but are still in question in line construction.—*Elektrotechnische Zeitschrift.*

The Mission Telephone

Near the middle of the meeting, says the *New York Herald,* the mission telephone bell rang. Presently the clerk interrupted the services to say:—

"Is Harvey McIntyre here? He is wanted at the 'phone."

Without saying a word a poorly dressed man got up from a seat near the door, hurried down the aisle and across the platfrom to the telephone booth. When he reappeared he stopped by the superintendent's chair and sought permission to address the audience.

"Fellows," he said, "I've got a job. This afternoon I asked a man for work. He couldn't answer me then, but he said if I would tell him where to find me maybe he would let me know tonight whether he could take me on or not. I looked up the telephone number of this mission, and asked him to call me up here. He has done it and I go to work tomorrow."

That brief address formed the keynote for the rest of the unusually successful meeting. At the close of the service a friend complimented the mission superintendent on his clever stage management.

"You mean that fellow McIntyre?" he said, "you think I planned that? Well, I didn't, but it was tremendously effective.

"The thing happened just as McIntyre said it did. A lot of fellows whom we do not know give our telephone number and ask to be called during services.

"The trouble it put us to made us discontinue the privilege once, but when we saw how many men profit by the mission services while waiting for telephone calls we reinstated their ancient rights."

Omaha Telephone Company Sold

The Independent Telephone Company's plant (automatic) in Omaha was sold at receiver's sale today for $995,000, the Nebraska Telephone Company (Bell) being the purchaser.

The plant has been in operation six years and was bonded for $2,400,000, Los Angeles and Portland capitalists being the bondholders. They will realize about 25 per cent on their holdings.

The Independent company had a floating indebtedness, including receivers' certificates, of $400,000, about $300,000 of which is a preferred claim. The purchaser will take control at once, but local officials could not say whether or not the plant would continue to be operated independent of the local Bell system. The deal is said to be the largest of the kind ever made.

Standard Methods of Dry Cell Testing

American Electro-Chemical Society*

USERS of dry cells may be divided into three classes: the average ultimate consumer, the large user, and the manufacturer. No standard methods of testing can be devised which will be suitable at once for all of these classes, and the most serious obstacles are encountered in formulating methods suitable to the first class. This is unfortunate, since by far the larger proportion of the dry-cell output is so distributed that the user is interested in one, two, six, or perhaps twelve cells as supplying his yearly requirements. This very large number of users should have a test the cost and labor of conducting which should not be out of proportion to the low values of the articles tested. There appears to be no adequate means of meeting this urgent demand for simplicity of equipment and method.

Large users of dry cells, such as telephone exchanges, engine manufacturers, installers of alarm and signal devices, railroads, etc., who purchase cells in large quantities, are especially interested in testing methods. Various methods of testing have been evolved by these users as a basis for purchase specifications and as a means of judging the relative merits of the various makes of cells on the market. To them the matter of elaborateness of tests is of less importance than to the small user.

Of even greater importance is the testing of dry cells by the manufacturer, who must necessarily adopt methods which will give him the necessary information concerning his product, no matter how elaborate.

The methods of testing recommended are those which are particularly suited to the second class—the large users. These tests, if extensively adopted, will be of indirect benefit to the small consumer, and will be of mutual advantage to the large users and manufacturers.

It has been suggested that the methods for testing should include, aside from electrical measurement, methods of physical and chemical analysis, such that judgment may be made thereby of the merits of a cell, and that what constitutes a satisfactory product should be described in these terms so that they might form a basis of specification. There is a striking similarity between the various cells on the market as far as materials used and general structure are concerned. Exceedingly slight variations, however, which introduce large variations in the quality of the product, are not capable of detection by physical and chemical examination, and what is of even greater importance in determining the quality are the methods of assembling, such as methods of mixing, grading as to size of the particles which constitute the cell mixture, and methods of tamping, factors which cannot be easily determined by physical or chemical inspection of the resultant product.

The art of dry-cell manufacture cannot be considered as having been worked out to a finality; improvements are being made and will continue to be made. One maker may discover a simple method of neutralizing the effects of an impurity on his product which may have a detrimental influence in another product, and a judgment based upon the detection of such impurity would thereby work an injustice. The tests, therefore, should be such as determine the ability of the cell to produce results, and these can be determined only by tests involving electrical measurement. The dry cell, in all of its multitudinous uses, is merely a source of electrical energy, and its ability to deliver this energy, in the quantity and at the times desired, constitutes the principal measure of value.

Dry-cell tests may be conveniently divided into three main groups: (1) Tests to determine whether or not a cell is in good condition before being placed in service. (2) Tests to determine the actual or comparative service capacity of cells. (3) Tests to determine the rate of deterioration of cells on open circuit. This classification is followed in this report.

TESTS TO DETERMINE CONDITION OF A CELL BEFORE USE.

Electromotive force.—The electromotive force of a cell may be read by connecting a voltmeter directly across the terminals. In new cells of various types the electromotive force may vary from 1.5 to 1.6 volts. If a cell of the type now in general use gives an electromotive force less than 1.45 volts it is an almost certain indication either of serious deterioration due to age, or of the external short-circuiting of the cell, or of some defect such as an internal short-circuit, which will soon render the cell unfit for service. It is seldom necessary to measure the open-circuit voltage of cells, since they are seldom deficient in this respect. It is a test which may be considered as secondary in nature, and should be applied when it is suspected that the cells are below standard, for example, when cells are received with wet packets, when the terminals are corroded, when the electrolyte leaks from under the seal, or when the cells are abnormally low in short-circuit current.

An accurate or carefully calibrated voltmeter should be used, the resistance of which is sufficiently high to render the current flow through it inappreciable. A two-scale Weston instrument of 300 ohms resistance with 3-volt maximum deflection and 1,500 ohms with 15 volts maximum deflection has been found very satisfactory for both cells and batteries. Cheap pocket instruments are often so inaccurate as to make their indications of open-circuit voltage worse than useless. The effect of temperature on electromotive force is very slight.

Short-circuit Current.—The short-circuit current of a cell may be obtained by connecting an ammeter directly across the terminals of the cell. The short-circuit current of a cell is of value only when coupled with a familiarity with the brand of cell in question. If the reading is normal for that brand of cell, it is reasonably certain that the particular cell is in good condition, and that it will probably give as good service as others of the same make. This applies only to cells of the same brand and make. That the short-circuit current of a cell of a new and unfamiliar brand is as high as that of another brand is no indication whatever of the equality of the service capacities of the two cells. The short-circuit current bears no relationship to service, and when measured without reference to temperature or other conditions may be entirely meaningless and misleading.

The ammeter for reading short-circuit current should be deadbeat, and with its leads should have a resistance

*Abstract of a paper read before the Washington and Baltimore sections of the American Institute of Electrical Engineers.

of 0.01 ohm, to within 0.002 ohm. Two 30-inch lengths of No. 12 lamp cord make very convenient leads. The maximum swing of the needle should be taken as the short-circuit current of the cell. The ammeter should be connected across the brass terminals of the electrodes. Low readings are likely to be obtained if the ammeter is applied to the carbon electrode directly. In order to avoid high contact resistance, the terminals of the cells and of the ammeter leads should be brightened. It has been found very convenient to fit the ammeter leads with small terminals of lead. The contact on the cell terminals is greatly improved, and with such leads it is unnecessary to brighten the contacts. For accurate measurement of the short-circuit current of a new cell, instruments of the pocket type should be avoided. The effect of temperature on the short-circuit current is quite pronounced. The amperage of cells is raised about one ampere for each 10 degrees centigrade rise in temperature. This value varies considerably with different cells, and is somewhat greater at the lower temperature and less at the higher. At very low temperatures the effect is very pronounced, and it is often noted that cells received in extremely cold weather read but one or two amperes. On bringing them to room temperature however, the short-circuit current becomes normal and the cell is not impaired by the freezing.

Internal Resistance.—This value is usually determined by applying the formula

$$R=(V-V')/C$$

where V is the open-circuit voltage of the cell, V' the closed-circuit voltage, and C the current to which the cell is subjected in order to make the determination. The value obtained varies with the current flowing, the age of the cell, and the temperature.

For these reasons we advise against the use of this test. It indicates nothing in regard to the service capacity, nor does it give an exact value of the actual internal resistance of the cell.

SERVICE CAPACITY TESTS.

In general there are but two reasons for desiring a service test upon dry cells: (1) to ascertain what life may be obtained from a brand of cells in a certain service; (2) to ascertain which one of several brands will give the longest life in that particular service.

With the former object in view the knowledge is best obtained by actual use of the cells in connection with the appliance. In some cases this is the only feasible way in which the definite information sought can be obtained. The great majority of tests are carried on, however, with the second object in view. Where the amount of testing is large, it is impossible, even were it expedient, to use the actual appliances for testing cells, and it becomes necessary to devise special testing methods and apparatus such that results obtained therefrom shall be comparable to the results obtained from the cells when placed in actual service.

It has been suggested that cells of various makes be tested by connecting them in series and discharging them simultaneously through any suitable resistance, thereby assuring that the cells are discharged at the same rate and under identical conditions. There are several objections to this method and we therefore advise against the testing of cells in this manner.

In interpreting the results obtained from a test of various grades of cells, we wish to caution against drawing definite conclusions from the outcome of a single test or of a small number of tests. When the matter of choosing a brand is of much importance, it is necessary to run a series of tests over a period of six months or a year. In this way a very good idea may be obtained of the average service results which may be expected.

SERVICE TESTS RECOMMENDED.

Telephone Service.—Discharge three cells, connected in series, through 20 ohms resistance for a period of two minutes each hour, during 24 hours per day and seven days per week, until the closed-circuit voltage of the battery at the end of a period of contact falls to 2.8 volts.

The following readings are taken: (1) Initial open-circuit voltage of the battery. (2) Initial closed circuit voltage of the battery. (3) Closed-circuit voltage at the end of the first discharge period. (4) Closed-circuit voltage at the end of a discharge period after three days, and weekly thereafter.

Report the results as the number of days during which the closed-circuit voltage remains above the limiting value of 2.8 volts.

Ignition Service.—Discharge six cells connected in series through 16 ohms resistance for two periods of one hour each per day, seven days per week. The periods should be eleven hours apart, but in cases where the circuits are not automatically controlled, the first and the last hour in the working day may be chosen for the discharge periods and the discharge omitted on Sunday, without materially affecting the results.

The following readings are taken: (1) The initial open-circuit voltage and short-circuit current of the battery. (2) The initial closed-circuit or working voltage, and the initial impulse of current which the battery is capable of forcing through a 0.5-ohm coil connected in series with an ammeter, and in parallel with the 16-ohm coil. (3) Closed-circuit voltage and impulse current through the 0.5-ohm coil at the end of the first period of closure, at the end of the sixth period, at the end of the twelfth period and after every twelfth period thereafter.

The test is considered completed when the impulse current at the end of a period falls below four amperes. Report the results as the number of hours of actual discharge to the limiting value of impulse current.

Particular care should be taken to keep the temperature of ignition test batteries as nearly constant as possible, as the service obtainable is greatly influenced by this factor.

Flash-light Batteries.—Discharge the battery to be tested through a resistance of four ohms for every cell in series (eight ohms for a two-cell battery and 12 ohms for a three-cell battery), for a period of five minutes once each day until the closed-circuit voltage at the end of a discharge period falls to 0.75 volt per cell (1.5 volt for a two-cell and 2.25 volts for a three-cell battery).

The following readings are taken: (1) Initial open-circuit voltage and short-circuit current. (2) Initial closed-circuit, or working voltage. (3) Closed-circuit voltage at the end of the first, third and seventh periods of closure, and after each seventh period thereafter.

Report the results as the number of minutes during which the battery was discharged through the resistance to the given end point.

In case the circuits are not operated mechanically, the results are not materially changed if the batteries are discharged only on working days. Four ohms per cell is chosen for the resistance in circuit, since the tungsten bulbs generally used with a three-cell battery have a resistance of approximately 12 ohms.

Miscellaneous Service.—In addition to the telephone

and ignition services, which are by far the most important services in which dry cells are used, there are numerous other services, among which may be mentioned the operation of automobile horns, sewing-machine motors, small fans, toys, massage vibrators, cigar lighters, bells, buzzers, etc. In the aggregate these miscellaneous services consume enormous numbers of cells, but they are so numerous, and there are such variable conditions prevailing in each kind of service, that it would be useless to attempt to develop standard tests covering them.

It is not difficult for anyone particularly interested in any special service to arrange a suitable test for himself. Care should be taken to make the conditions of test, viz., number of cells, resistance in circuit, period of drain, etc., approximate those of the service in question.

RATE OF DETERIORATION ON OPEN CIRCUIT.

The voltage and short-circuit current of the cells for test are read initially in order to insure that the cells are in good condition. The cells are then stored in a dry place of normal room temperature.

The following readings are taken: (1) Initial voltage and short-circuit current. (2) Short-circuit current at the end of four weeks, eight weeks and each eight weeks thereafter. (3) Voltage at the end of six months.

The cells are kept on the shelf until the short-circuit current has fallen below 10 amperes. This point is arbitrarily chosen, as it represents a point below which it would be difficult to market the cell. For practical purposes, the results are expressed as the number of months during which the short-circuit current remains above this cut-off point. Much more meaning, however, is attached to the rate at which the current falls, generally reported as the drop in amperage for a given period expressed as a percentage of the initial amperage. This is especially true when investigation of the quality of cells is the object. For practical purposes, however, the first rating given, i. e., months to 10 amperes, is perhaps preferable.

The results from this test are largely indicative of increase in internal resistance, and bear no definite relation to the service which the cells may give. However, this information, coupled with familiarity with a brand of cells, becomes a very good indication of its quality. It also serves to indicate any serious defects of manufacture.

The ammeter for reading short-circuit current should be deadbeat, and with its leads should have a resistance of 0.01 ohm. Particular attention should be given to the temperature at which cells are stored, as the rate of deterioration is influenced to a marked degree by the temperature of the cells.

The ideal method for an open-circuit deterioration test would be the determination of the decrease of service capacity due to storage over definite periods. This practice, however, would entail much labor and expense where the amount of testing to be done is large.

ADAPTABILITY OF TESTS TO NEEDS OF CONSUMERS.

The question may arise in the mind of the consumer as to what extent the cells he purchases should be tested. It obviously would not be practical for the small consumer to conduct tests on the same scale as those carried on by a consumer using many barrels of cells per year. It is impossible to formulate any set rules for sampling and testing for any consumer or group of consumers, as the amount of testing done must be regulated by the relation of the cost of testing to the value of the cells purchased. However, we present here suggestions as to the adaptability of these methods to several roughly classified groups of consumers.

The Small User.—In this class may be included the great percentage of consumers. We advise that every cell purchased be read for short-circuit current. Although this reading gives no direct indication of the service capacity of the cell, yet, if the reading is normal for that brand, it may be reasonably certain that the cell is in good condition. It would be impractical for the small user to provide himself with an expensive ammeter, as, for his purpose, a good make of pocket instrument will give readings sufficiently accurate.

The Small Dealer.—This class comprises those dealers who may dispose of from a few hundred to a thousand or more cells per year. The dealer is particularly interested in keeping the quality of his stock up to the standard. As cells are received a representative sample, say 10 per cent chosen at random throughout the lot, should be read with a reliable ammeter. If the readings are normal it would scarcely profit to make any further tests. For his protection all cells should be read with the ammeter before being delivered to customers.

The Jobber.—The jobber buys and sells dry cells largely by barrel lots, and in many cases conducts no tests whatever. If he is desirous of keeping his quality strictly up to standard it would be well to open several barrels in each shipment and test with an ammeter a dozen cells chosen at random throughout the barrel. If the large jobber wishes to carry the best grade of cell for any service, it would probably pay him to conduct the recommended telephone and ignition tests on a small scale.

Telephone Companies.—The small telephone company consuming less than ten barrels of cells per year could install a standard telephone test of small capacity by fitting suitable electrical contacts on a clock and connecting these with a telegraph relay in such a way as to cause the latter to open and close the dry-cell circuits. We would advise that such a test be maintained by each company and that periodical tests (at least four per year) be made on the shipments of cells received and also on small lots of other brands purchased from time to time for the purpose of test. The small company should also test a representative sample (say 10 per cent) of all consignments received with a good ammeter.

The large telephone company using many barrels of cells per year can well afford to install an apparatus for carrying on the test suggested in this report. We would advise that a battery of three cells from each consignment received be placed upon the telephone test. In addition the short-circuit current and open-circuit voltage should be read upon a representative sample of all cells received.

Gas-Engine Manufacturer.—To the gas-engine manufacturer it is important that the batteries furnished with his engine be the best cells obtainable from an ignition standpoint. As the apparatus necessary for carrying on the ignition test is quite inexpensive and as the test requires very little attention, the manufacturer of such engines purchasing a considerable number of cells should conduct the ignition test not only as a check upon the cells he is receiving, but as a basis for judging the merits of the different grades of ignition cells on the market. An ignition test upon six cells from every fifth barrel received with a maximum of two tests for a single consignment of cells, would probably be sufficient. Before being sent out with an engine the short-circuit current on all cells should be read and those reading abnormally low (5 amperes below the average for the brand and grade) should be rejected.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

TO resolve that your son shall go through college is one thing—to put him through is another. It was decreed that Albert L. Salt should go, but it never materialized, because he was too good an employee to lose. Young Salt, like most boys of his or any other day, worked during school vacations. When he was fifteen, he worked for the Western Electric Company. When he was sixteen he found the concern ready to receive him again. He also discovered that it was harder to get out than it was to get in. In truth, it was the company that prevailed on the parents to give up the notion of sending the boy through college and a compromise was reached by way of the private tutor.

The Man Who Says Aye and Amen.

Business, like romance, carries all the necessary paraphernalia and sets it up anywhere. Some call it destiny; others call it luck, but no matter, it works out in its own sweet way. A few years ago, when the Moore Brothers grabbed up the great Rock Island railway system, while Wall street was asleep, they followed up the first big surprise by electing a man to the presidency at a hundred thousand a year. The newspapers were giving lots of space to the story and the reporters were asked to find out about the new president; where he came from; who he was; to what did he credit his rise. Finally, he gave the secret away by saying he had trailed behind a bunch of live ones!

So it has turned out that Albert Lincoln Salt made a connection thirty-one years ago to his own and a great concern's advantage. Thirty-one years on the job out of a total of forty-seven is an extraordinary record, but then, Salt is something of the extraordinary and so is his job.

The men who are chosen for their peculiar fitness to spend other people's money are few and far between. The telephone business has a few of them, but they make a poor showing when the purchasing agent of the Western Electric Company discards his worn-out adders after the annual expenditures are totalled. Mr. Salt has been spending money for years and years. He is the biggest buyer of telephone materials in the world and he finds the requirements of his several companies growing larger as he grows older. "Brewster's Millions" was a dull story for this telephone man. If you want the simple formula of spending a million dollars, or a hundred millions of dollars, ask Salt of the W. E. Send stamped, self-addressed envelopes for reply. He has no appropriation for idlers.

The life isn't all roses. If you ever had occasion to look at big organization charts, which show the executive lay-out, you will begin with the stockholders, then the directors, then the executive committee, the president, vice-presidents and other officers. The purchasing agent usually has a circle over on the right-hand side of the sheet, but the lines lead from that circle to practically all the others, which implies that all interests must be conserved. The executive committee; the president; the treasurer; the auditor; and the directors and shareholders all have a look-in, but they can't spend the money. Mr. Salt has all the honors. He does the buying. If you have something to sell to his companies, get after the testing laboratories, at the inspectors, or the engineers on this and the other side of the world. When you have created a friendly concern in your product, maybe you have a chance. If you can prove efficiency, or a better product, or both, there will be reason for your seeking audience with the man who says aye and amen. Great institutions work day and night, all the year around, filling Salt's orders. They never have anything else to do. Everything that goes into Western Electric construction, maintenance and equipment of plant and its manufactured product, goes through Salt's hands. He must know. His department is the whole life of Western Electric Company, and Western Electric Company manufactures practically everything that is used by American T. & T. and its subsidiary companies. It's the biggest one man's telephone job of them all.

You are given just one guess at the year of Mr. Salt's birth. His middle name is the answer. He barely escaped being an Abraham Lincoln baby, due probably to his having been born in Brooklyn. The exact date was October 4, 1865. Having been denied a college training his studies were

kept up till he was twenty-five. He held his job and his tutors held theirs. He was married April 15th, 1891, and his son, Lloyd Bergen Salt, has finished St. Paul's at Concord and is now attending Chauncey Hall, preparatory to entering Boston Tech.

Albert Lincoln Salt, for business, social and fun, belongs to the Union League Club, Chicago; the Railroad and Engineer's Clubs, New York; the Baltusrol Country Club, Short Hills, N. J.; and the Canoe Brook Country Club at Summit, N. J., where he lives in a large home with beautiful surroundings. His real hobby is his hunting and fishing camp in Maine —one of the state's finest—at the head of Umbagog Lake. He modestly refers to it as Saltaire Lodge, but he carries a collection of photographs to convince the skeptic that it is charming. The heated season is all too short for the outings he enjoys at Saltaire Lodge.

Like other men of importance in the industrial world, Mr. Salt goes in for automobiles and golf, but he includes motor-boating and fishing as well. Lake Umbagog offers splendid opportunity for the latter. Fly casting, beyond all things else, is the trick that brings complete joy to his soul. If you want to land a quick order, get his attention without wearying yourself with engineers and inspectors and testers, take flies. He'll buy a peck at your price and give you shipping instructions without pushing a button.

The Law and the Telephone

By E. J. Wenner

LIABILITY OF TELEPHONE COMPANY TO PERSON INJURED BY ELECTRICITY THOUGH NOT IN ACTUAL CONTACT WITH WIRE OR INSTRUMENTS—NEGLIGENCE OF COMPANY AND OF INJURED PERSON DISCUSSED.

A CONSIDERABLE number of cases have been tried wherein the plaintiff or injured person suffered through actual contact with telephone wires or instruments. In few jurisdictions have there been decisions touching upon the liability of the company where injury resulted from what might be termed atmospheric electricity, the injured person being in close proximity, but not in actual contact with lines or instruments. Injuries are frequently inflicted on persons in houses where telephone instruments have been removed, and the wires have been allowed to remain, the injuries being caused by lightning conducted into the house over the unremoved wires.

The courts recognized a difference in the degree of care required on the part of the telephone companies where telephone instruments are in use and where the instruments have been removed and the wires left attached to the house or building. It seems that a higher degree of care is exacted in the latter case than in the former. The courts of North Carolina and Alabama have decided that where a telephone is in use in a building and due care is used in minimizing the danger incident thereto, the consequences are to be risked by the patron in consideration of the public convenience of the telephone. Where services have been discontinued and the instrument removed and the wires are left in the building with exposed ends, no consideration of public policy justifies the danger created by leaving the wires exposed. Such an act on the part of the company is negligence and would justify the recovery of damage by any person rightfully on the premises if injured by lightning conveyed over the wires.—Southern Bell Tel. Co. *v.* McTyre, 137 *Alabama* 601; Starr *vs.* Southern Bell Tel. Co., *72 Southeastern Reporter* 484.

The Supreme Court of Texas recognizes the degrees of negligence on the part of a telephone company and held that where the evidence showed that twisting the line and ground wires together was one of the safeguards to prevent lightning from entering the premises, also that a lightning arrester was a better safeguard, it was the duty of the telephone company to use the latter method if it desired to be free from actionable negligence.

The court took the position that a telephone company was obliged to safeguard as much as possible and to use approved appliances to prevent injuries from lightning conducted over its wires. It was held that the proper test was not whether the defendant used the best methods known to it, but whether it used ordinary care to select and use the best methods known to science.—Texas Tel. Co. *v.* Scott, 127 *S. W. Reporter* 587.

In the case of Griffith *v.* New England Telephone Co., *72 Vt.* 441, *52 L. R. A.* 919, the facts showed that the telephone had been installed and was in use, though the evidence showed the instrument to be defective. Lightning entered the house over the telphone wires and caused the death of a subscriber, who at the time was sitting near the telephone instrument.

The court took the position that the company having undertaken to place and maintain the instrument in the house and connect it with its telephone lines for the use of the deceased, it was under a duty to exercise the care of a prudent man in like circumstances. If in the exercise of such care they had reasonable grounds to apprehend that lightning would be conducted over its wires to and into the house, and there do injury to persons and property, and there were known and approved devices for arresting or dividing current so as to prevent injury therefom to the house or persons therein, then it was defendant's duty to exercise due care in selecting, placing and maintaining, in connection with its wires and instruments, such known and approved appliances as were reasonably necessary to guard against accidents that might be expected to occur when lightning is conducted into a house over telephone wires.

I quote from the opinion as follows:

No device, as a safeguard or protection against electrical disturbances, was attached to, or connected with, the instrument,

except on top, where there was a device consisting of two metal plates, which, to be complete, should be furnished with a wire attached to one of the plates and running to the ground, and between the two plates was a plug intended to "short current the two plates without entering the bell circuit," but owing to a defect in the construction of the instrument the plug did not serve the purpose for which it was intended. When the jury had found what the force was and its extent, it was for them to say whether there were known and approved appliances for arresting, diverting and controlling such force so as to prevent injury; and whether the defendant was negligent in not providing such appliances; and whether the deceased came to his death by reason of such neglect.

Upon the question of contributory negligence, the court said:

The evidence tended to show that a telephone line, by the use of known and approved appliances, and by proper ground connections, may be so constructed that the telephone instruments will be comparatively safe; that there were no such appliances or connections at or near Dr. Sawyer's house that were intended, in their then condition, to guard against accidents from such lightning as the evidence tended to show killed Dr. Sawyer; that there was a plug with the instrument, which was intended to be inserted between the plates on top of the instrument, for the purpose of cutting the current of electricity out of the instrument; and that, just before Dr. Sawyer was killed, his daughter placed this plug between the plates, but there was no ground connection, and the hole under the plates was too small to receive the plug, and, by reason of these defects, it did not serve the purpose for which it was intended. There was also evidence to show that the storm came on without much warning. One witness, at least, testified, "It seemed to come up sudden." Upon this evidence, it was for the jury to say whether the deceased knew, or ought to have known, that the instrument was not provided with proper appliances and ground connection to guard against injurious effects from lightning when conducted to his house over the defendant's telephone line; whether a prudent man, in like circumstances, would have assumed that the defendant had done its duty in these respects, and omitted to inquire or investigate for himself; whether the deceased knew, or ought to have known, that a storm was approaching; and whether he knew, or ought to have known, of any facts that would have warned a prudent man in like circumstances of approaching danger and caused him to take measures of his safety by going to some other place, or doing something that was omitted by the deceased.

ADMISSIBILITY IN EVIDENCE OF TELEPHONE CONVERSATIONS—CONVERSATION ADMITTED BY PLAINTIFF MAY BE PROVEN BY ONE WHO HEARD A THIRD PARTY CONVERSING WITH PLAINTIFF.

In Piper *vs.* Krutzfeldt (Iowa) 136 *N. W.* 904, the court held that testimony of defendant's wife as to a telephone conversation with plaintiff should not be stricken from the evidence, even if it developed on cross examination that the conversation was between plaintiff and a daughter of the witness. The witness heard only her daughter's voice, but knew, from what she said, the general nature of the conversation. The plaintiff had previously admitted on cross examination having had a similar conversation with some person.

The usual rule is that the witness must positively recognize the person speaking as the one against whom the conversation is sought to be used, and this case is the first one coming to the knowledge of the writer in which the court has held that a telephone conversation might be established by a third party. However, the fact that plaintiff admits such conversation in his own cross examination is a strong factor in the reasoning of the court.

INJURY BY LINEMEN—CARE REQUIRED—LIABILITY FOR NEGLIGENCE—SUFFICIENCY OF EVIDENCE.

The plaintiff, Marjorie A. Souther, is a resident of St. Paul, Minnesota, and resided with her husband who owned real estate described as lot one, block four, Woodland Park. The premises front on Aldine street, and between the curb line and the sidewalk a strip of land nine feet wide was maintained as a boulevard.

The defendant, Northwestern Telephone Exchange Company, operates a system of telephone lines in the city of St. Paul and had permission from the city to erect a line on Aldine street and to place poles in the above mentioned boulevard.

On the morning of May 23, 1910, an employee of defendant was sent to dig a hole for a pole in the boulevard in front of plaintiff's residence. After the hole had been started the plaintiff learned of it and ordered the workman to stop digging. He complied with the order, but in the afternoon of the same day defendant's foreman with fourteen workmen started digging the hole. Plaintiff's husband was away from home, and she, with the assistance of her servant, remonstrated with the workmen and endeavored to prevent the digging of a hole in the boulevard. She threw water upon them with a hose, threw dirt upon them and placed herself in the hole so as to prevent the workmen from digging. The workmen started other holes and moved a pole about in such a way as to frighten plaintiff. While she was in one of the holes a workman threw a pike pole in beside her, later partially removed it and then pushed it back, the latter time cutting and injuring the plaintiff. She was roughly handled and was thrown to the ground, the evidence not being conclusive as to whether she was injured by the telephone pole or a pike pole in the hands of a workman, and for a time was unconscious.

Plaintiff brought action against the defendant claiming damages on account of the personal injuries received at the hands of its employees, and alleged the acts of the workmen to be unlawful and to constitute negligence. Plaintiff claimed that she had no knowledge of permission having been granted to the defendant to place a pole in front of her husband's property, and claimed to be acting within what she believed to be her rights in remonstrating with the servants of defendant against digging the hole and setting the pole. She claimed the conduct of the defendant's servants was such as to constitute a wanton act for which defendant is liable.

There was some conflict in the evidence, but the court's instructions were that if the jury believed the claims of plaintiff to be true, the injury was wanton and the defendant liable therefor. The jury returned a verdict in plaintiff's favor for $700 damages.

Upon appeal the Supreme Court affirmed the judgment of the court below, though it found some fault with the instructions concerning wanton negligence, but said the jury was not misled thereby.

The Supreme Court held that the plaintiff's husband was the owner of the fee to the boulevard and that his title extended to the middle of the street upon which his premises abutted, subject only to the easement of the public. The plaintiff therefore being the wife of the owner had a right to go upon and be upon the boulevard, and was not in anywise a trespasser thereon.

The court held that the defendant did not have a right to enter the boulevard by force even though the city had given it permission to erect a line thereon. The license from the city did not, and could not

authorize the defendant to take possession of the boulevard, or otherwise to assert its right in a violent or an unlawful manner. "Taking the remedy into one's own hands is at best an insult to the majesty of the law, and the offense is greatly aggravated whenever it is committed under circumstances evincing deliberation." The law cannot countenance the substitution of physical violence in the place of the peaceful remedies of the law. "The rule rests upon a denial of the doctrine of might, and provides peaceful methods for the attainment of social justice, regardless of the strength or weakness of the contenders."

I quote from the opinion of the court as follows:

> We do not think the case before us was one in which either the right or the emergency justified the course resorted to by the defendant's servants. The defendant had a mere license to proceed in an orderly, lawful manner to erect the pole upon this boulevard, and the plaintiff's resistance, under color and claim of right, and, as far as can be gathered from the record, in perfect good faith, did not authorize the forcible invasion of the boulevard. The defendant's remedy by resort to the courts was ample, and there seems to have been no such emergency as would have rendered a delay prejudicial to its rights. The defendant cannot, therefore, claim exemption from liability for the consequences of the acts of its servants, merely because the ultimate purpose they were seeking to accomplish was lawful. "The law will not lend its sanction to an act, otherwise lawful, which is accomplished by unlawful means."
>
> As we have seen, when the defendant's servants returned in the afternoon to set the pole, they had knowledge of the plaintiff's insistance that the company had no right to place the pole on the boulevard, and the plaintiff was in possession, and yet they proceeded, if not to throw her off the boulevard, at least to forcibly assert the defendant's rights in the premises. What they should have done is to have complied with her orders and appealed to the law; and the defendant having instead of appealing to the law, assumed to be the judge of its own rights, and endeavored, through its servants, to accomplish its purpose by force, with knowledge of the plaintiff's claim and of her position of danger, if, through the wanton negligence of such servants, the plaintiff was injured, we know of no rule of law which will exempt the defendant from liability therefor.—Souther *vs.* Northwestern Telephone Exchange Company, 136 *Northwestern Reporter*, 571 (Minnesota).

City Plans to Seize Company

To seize the telephone property and operate the telephones of Denver as a municipal property is the intent of an ordinance by Alderman M. V. Spaulding, of the eighth ward, that will be introduced by him in the board of aldermen.

The move in the board of supervisors to reconsider the Kindel bill for a reduction of telephone rates was made in connection with this bill.

Alderman Spaulding's bill recites that the telephone company has no franchise permit or any rights whatever to the use of the streets and alleys of the city and county of Denver; that in occupying the streets and alleys it is violating the city laws and is subject to seizure. It proposes that the mayor, auditor, sheriff and board of public works or "such other officers and boards" as may be deemed necessary, at once seize the property of the telephone company; that condemnation proceedings be begun immediately and that there be an adjudication of the value of the "poles, wires, buildings, plants" and such other property necessary for the operation of the telephone system to be purchased by the city.

The move is made in the interest of a municipally owned telephone company. Spaulding said that he was confident of the passage of his bill in council under a suspension of the rules and that he had promises from the board of supervisors that the bill would be promptly passed by the supervisors.

The statement is made today that the Kindel bill introduced and passed by the board of supervisors is in reality a franchise for the telephone company; that it recognizes the rights of the telephone company to the streets and alleys of Denver, and that similar recognition under similar conditions in various sections of the country has resulted in the courts holding that such recognition constituted a franchise for the corporation.

City Attorney Bryant, when asked for his opinion on this, replied that he thought it best to postpone the Kindel ordinance until later, when it could be taken up, and intimated that it was not a correct ordinance. It is said that Bryant has officially told Kindel and several of the aldermen that the Kindel ordinance is in accordance with the telephone company's desires and would constitute a recognition of the rights of the company to the streets and alleys.

The passage by the board of supervisors of a resolution by Walker repealing the ordinance passed by the Speer board of supervisors accepting $25,000 a year for use of the streets and alleys from the telephone company, was because the acceptance of that money was also a legal recognition of the rights of the company to the city streets and alleys.

Wisconsin Commission News

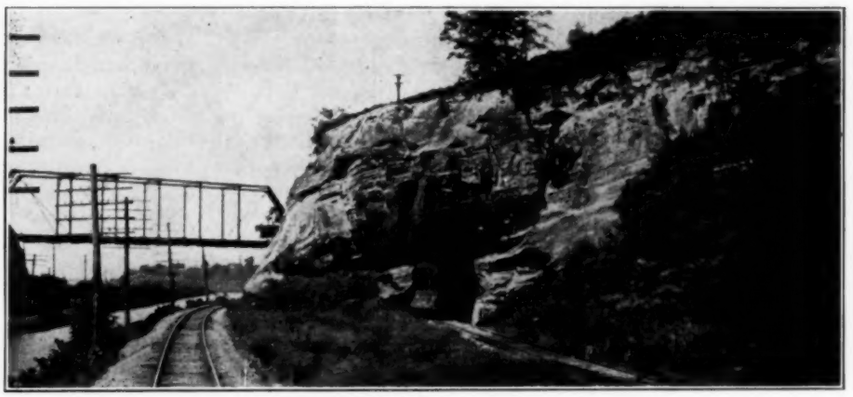
The Wisconsin Railroad Commission has granted the Farmers' Telephone Company, Richland Center, permission to increase its rates as it was found upon investigation that after allowing for depreciation there still remained quite a deficit which must be covered before there would be anything available as interest on the investment. Rural lines and toll lines owned by other companies have been furnished free switching services by this company and it is claimed by the commission this service should yield sufficient revenue to cover the costs incurred. The charge for switching under the new rates is based upon the proportionate cost of the service. An increase of 25 cents per month was ordered for local residence and business telephones. The practice of supplying both residence and business service on the same two-party line was abolished, having been condemned by the commission.

Oklahoma Commission News

The Pioneer Telephone and Telegraph Company objects to the order of the Corporation Commission requiring all companies to mark their poles and other structures in some manner so as to identify them as company property, claiming it would cost $14 a pole or a total expenditure of about $11,800. It is stated that the telephone and telegraph companies of New York have been able to do this at the rate of about $2.50 per pole.

Upon complaint of the Fort Supply Telephone Company that the switching charges imposed by the Home Enterprise Telephone Company of Woodward were excessive, and after considering rates charged at other points and by other companies, the Corporation Commission has ordered a rate of 20 cents for a three-minute talk between Woodward and Fort Supply, with five cents extra for each additional minute.

DEPARTMENT OF RAILWAY TELEPHONES



A Virginian in Texas

E. E. Backus, E. P. & S. W.

THIS is about a Virginian. You've heard about those Virginians in play and story—stalwart, upstanding gentlemen, full of chivalry and quick to resent a slight. The history of the state breathes romance, from Washington to Wilson, from the northwestern border of the Allegheny Mountains to miniature Princess Anne county, hidden in the extreme southeast corner of the state map. That's where Edward Evans Backus came from—Princess Anne county. It is not necessary to specify the particular spot, for the county itself is smaller in area than Chicago, and has only 11,500 inhabitants today. Presumably when E. E. Backus first saw it, forty-four years ago, it had less.

Edward E. Backus, El Paso & Southwestern.

As for the romance, Edward E. doesn't show it at first glance. He is substantial, aggressive, well-nourished, practical. Put him on horseback, though, with a broad-brimmed hat, and you would have a different picture.

The responsible men of America's railroads, as a rule, began their life's work early. Backus was fifteen years old when he began operating telegraph, and for three years he was employed in this work by various railroads about the country. In that period he also operated for the Western Union Telegraph Company, the Mutual Union Telegraph Company and the Public Grain and Stock Exchange, New York, and became manager of the latter concern at Bridgeport and Danbury, Conn., branch offices.

In the five years from 1887 to 1892 Mr. Backus was successively telegraph operator, Wheatstone chief, and traffic chief of the through western division for the Western Union Telegraph Company at 195 Broadway, New York, quadrupler and Wheatstone repeater chief for the same company at Lynchburg, Va., and in construction work on the Quimby Railroad concession in Venezuela, South America.

Perhaps it was some of that Virginian romance that headed E. E. Backus for Equatorial America. Most of us get, sooner or later, that hankering for a sight of foreign parts. Few of us gratify the hankering beyond a visit to the moving picture show when travel pictures are running. Backus got his in Venezuela and, satisfied, returned to this country in less than a year. On this return in 1892 he joined the engineering staff of the American Telephone and Telegraph Company, where he remained until 1898.

The following nine years he spent wth the New York and New Jersey Telegraph Company, first as construction engineer (1898 to 1900), then as assistant division superintendent of the New Jersey division (1900 to 1901), and finally as superintendent of plant with headquarters at Newark, New Jersey.

Up to this (1908) Mr. Backus' experience had all been along technical lines.

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

A Virginian in Texas 95-96
Delaware and Hudson to Use Telephone Dispatching..... 96
Dispatching on the Washington and Old Dominion..... 96
Train Dispatchers Meet 96
The Railophone—A Safety System 97-98

He decided to branch out into a more commercial line of effort, and to that end became sales representative for the W. H. Perry Company of Boston, handling railroad and factory steel. This put him in touch with the railroads.

A thorough knowledge of telephone and telegraph work and an acquaintance with railroad men, when the railroads were just taking up the telephone as a substitute for the telegraph, led easily and naturally to an interest in railway telephone selectors, and so to a connection with the United States Electric Company, Chicago, as sales engineer. This engagement terminated September 1, 1911, when he became superintendent of telegraph and signal engineer for the El Paso and Southwestern System, with headquarters at El Paso, Texas.

Edward E. Backus is a member of the Association of Railway Telegraph Superintendents, the Railway Signal Association, and the American Institute of Electrical Engineers. He also helped to organize and was a charter member of the New York Telephone Society.

Delaware and Hudson to Use Telephone Dispatching

The Delaware and Hudson Railroad Company has lately placed an order with the Western Electric Company for equipment to be used in installing the first telephone train dispatching system to be used by that road. This apparatus will be similar in every way to the telephones furnished by the same company for use on most of the railroads of the United States which have adopted the telephone for handling train movements.

The train wire to be installed will extend from Albany to Troy, New York, with the dispatcher at Albany, and will take in the various yard offices and stations between these two points. A total of twelve stations will be equipped within this distance of eight miles. This is an extremely busy section of the road as more than two hundred trains pass over it daily.

The apparatus to be used is the No. 101-B selector set containing the standard Western Electric No. 50 type selector. The telephone equipment will consist of the new No. 147 transmitter arm, designed primarily for railroad work. It is arranged for fastening to the wall and when not in use can be pushed out of the way. The construction is rugged and has this advantage over desk stands, in that it cannot be knocked off the desk. A storage battery for furnishing ringing and talking current is also included in the new equipment.

Dispatching on the Washington and Old Dominion

The Washington and Old Dominion Railway Company, which operates from Georgetown, D. C., to Bluemont, Virginia, a distance of approximately fifty-five miles, as the electrification of a former division of the Southern Railway, has placed an order with the Western Electric Company for apparatus to be used in installing a complete telephone train dispatching system. This will be the first of its kind used on this road.

The system will comprise fifteen No. 101-B selector sets, containing the standard Western Electric No. 50 type selector. The telephone sets will be the "folding gate" type transmitter arms, which possess a great advantage over desk sets for this class of work. Four selectively operated semaphores will be placed at points along the right of way. These are controlled by dispatcher and are located where there are no regular operators.

The train dispatcher's office will also be equipped with a Western Electric No. 1800 sectional unit type magneto switchboard. From this board fifteen telephone circuits will radiate, the arrangement being such that the dispatcher can control the train wire and switchboard lines together or separately.

Train Dispatchers Meet

A three day convention of the Train Dispatchers' Association of America was held at Louisville, Ky., June 18, 19 and 20. Much discussion of an informal nature took place on the subject of the telephone as applied to train dispatching, and the result was favorable to the telephone on nearly every score. The common objection that the station operators could not keep so closely in touch with the train movements as with the telegraph was considered a minor fault, as appliances were now in the field which magnified the sound. With these devices the operator could hear the conversation as well as the click of the Morse sounder.

A report was made by the train rule committee recommending changes in the standard code of train rules. There was much discussion on the exclusive use of the "19" form of order, and the convention was largely in favor of its use, as many of the members testified to their use of the form both with and without the block system.

A resolution was passed directing the appointment of a committee of three members to wait upon the Interstate and Commerce Commission at Washington to protest against the passage of H. R. bill 25,040 amending the present hours of labor law, which would hamper railway operation without increasing the safety of either the employes or public.

This amendment would prohibit the service beyond eight consecutive hours in each twenty-four. The present law permits 16 hours service in the case of trainmen, and thirteen in the case of station men.

The following officers were elected: President, T. W. Kane, Livingston, Mont.; vice president, J. P. Finan, Needles, Cal.; secretary-treasurer-editor, J. F. Mackie, Chicago.

Automatic Equipment for Cordoba, S. A.

The Automatic Electric Company is in receipt of an order for automatic telephone equipment to be installed in the telephone exchange at Cordoba, Argentina, South America; the installation to be made for the United River Plate Company. The order comes through the Automatic Telephone Manufacturing Company, Ltd., Liverpool, England, in which company, the Automatic Electric Company is largely interested, and which has the sale of apparatus in Latin-American countries under its jurisdiction.

The Cordoba order provides for an immediate installation of 1,500 lines of central office equipment, with an ultimate capacity of 10,000 lines; the apparatus to be arranged for individual line unlimited service only, no party line or measure service being contemplated at this time.

Cordoba is a prosperous city located in the central part of Argentina and has a population of 60,000.

The Railophone—a Safety System

Telephoning to Moving Trains

FROM time to time we are shocked by hearing of railroad accidents causing greater or less loss of life, and it is significant that in recent years these have, in the great majority of cases, been caused either by some forgetfulness on the part of the signalman at a busy junction or by some temporary aberration on the part of the engine driver. The actual signaling equipment is scarcely ever at fault. It would therefore seem that future improvements in signaling equipment should have for their object the elimination, as far as possible, of the personal equation:

This has indeed been the line along which many inventors have been working, and the most usual course has been to place some apparatus on the locomotive to call the driver's attention to his mistake should he overrun a signal or otherwise enter the danger zone. The difficulty in all these systems, which are for the most part electrical in character, has, however, been the physical connection which must be established between the "land" circuits and the moving train. The inertia of a moving body such as an express train is sufficient to cause considerable damage to track apparatus, or at least to insure that its life will only be short. It has also been felt that to place any further apparatus on the locomotive is to increase to a dangerous extent the driver's already heavy responsibilties.

Both these disadvantages are overcome in the "Railophone" wireless inductive system of railway telephony, telegraphy and signaling, principally owing to the fact that there is no mechanical connection between track and train, and also because the various apparatus is placed under the charge of the guard rather than of the engine driver.

The electrical principle on which the whole system depends is that of induction. Briefly, the arrangements consist of one or more electrical circuits laid along the track it is desired to protect. These are connected with various telephonic and signaling apparatus in the signal box, and may be considered for the sake of clearness to make up the primary circuit of a transformer. The secondary circuit of the transformer is on the train. It consists essentially of two coils of wire wound round the frame of one of the carriages, these circuits being connected to various telephone and signaling apparatus in the guard's van. It has been found as a result of experiment that a current passing in such a primary circuit will induce a current in the moving secondary sufficiently strong to allow a telephonic conversation to take place, while it can also, through a sensitive relay, cause a warning signal to sound and the brakes of the train to be applied. In the same way it is, of course, possible for the guard of the train to get into communication with the signal box, and thus to transmit similar warning signals or take part in a telephone conversation. As will be shown later on, a good deal of the work done under this system is automatic, being effected by the condition of the various apparatus on the train and in the signal box when the former enters that part of the track protected by the circuits.

As an example of what it is possible to effect by means of this system it may be as well to describe the various demonstrations which were recently given at Stratford-on-Avon. The accompanying verbal description gives an idea of the arrangement of the apparatus in the signal box and on the train. In broad details the apparatus used in the signal box and on the train are very similar, but they vary according to the different purposes which they have to serve. For instance, at the signal box they control the movements of the signal levers, and on the train they control the vacuum brake.

The simplest operation is that of telephoning from signal box to train and vice versa. This is effected as follows: There are three track circuits that are mutually in telephonic connection laid in each protected section, one of which is connected to the telephone apparatus in the signal box. In this case the right-hand one of the three is used for telephone purposes, and extends throughout the whole length of the protected section. On the train are two insulated coils, one of which is connected to the receiver and the other to the transmitter of the telephone apparatus in the guard's van. It is therefore possible, directly the train enters a protected section, for a conversation to be held between it and the signal box. The apparatus is put in operation by lifting the receivers from their hooks. This action also cuts out the signaling circuits.

In the original "Railophone" system there was, however, no means of "calling up," and, as is still the case with wireless telegraphy on board ship, the operators had to be in constant attendance. This difficulty has now been overcome by the use of a detector, the joint invention of Prof. G. Kapp and Mr. von Kramer, which enables either train or signal box to be rung up, and incidentally also permits the carrying out of the various signaling operations described below. This detector is simple, and consists essentially of a pair of coils in a magnetic polarized system, a steel tongue, which begins to vibrate when an alternating current of a predetermined frequency passes through the circuit, and a contact breaking device. The tongue when in vibration opens a circuit, which, as can be seen from the diagrams, causes a howler to sound on the train or a bell to ring outside the signal box, as the case may be. The vibration of the tongue also breaks the local circuit of a secondary relay, and this secondary relay in turn breaks the circuit of a larger solenoid, which releases a weight and either puts on the brakes or operates the signal lever, as described below.

The next series of experiments were intended to show how a moving train could be warned from the signal box by means of audible signals, and even, if occasion required, be stopped altogether. As will be seen from the paragraph above the track circuits are divided into three groups, the main section which may be of only suitable length from 1 up to

*From *The Electrician*, London.

10 miles, the restoring section and the clearing section. The latter two sections are approximately 100 yards long. It will be noted that these last two sections are wound non-inductively for a large part of the distance from the signal box, so that they will not operate the apparatus except within a predetermined length.

Supposing now that "line clear" is given to an approaching train, that is, the signal is in the "off" position. When the train enters the section, the detector on the train, which is vibrating, also sets in vibration a similar detector in the signal box, which through the various relaying apparatus that is connected in circuit with it starts up the motor-generator, and thus puts the various equipment into a working condition. At the same time a red lamp is lighted over that particular signal lever which controls the semaphore protecting the section, and this lamp remains alight while the train occupies the main section. Simultaneously the detector also closes a bell circuit, causing a bell to continue to ring until the signalman protects the train from the rear by again removing the lever into the "danger" position. Should he fail to do this within a predetermined fixed period, the solenoid comes into action and automatically resets the signal. At the same time a powerful gong sounds outside the signal box. All these operations are recorded on the drum located just above the detector, and the signal lever is locked in the "off" position by the solenoid until the train has left the section. This renders it impossible for the signalman under any circumstances to open the section and admit a second train when it is already occupied. The possibility of doing this under existing conditions has, it will be remembered, more than once been the cause of serious accidents. If the signalman duly returns the signal lever to the "off" position, nothing happens in the signal box until the train enters the clearing section, which causes a change-over switch to operate and lights a green lamp. When the train leaves the clearing section the signal lever is unlocked by the solenoid becoming dead.

Should, however, a second train ignore the signal and enter the section while it is still occupied by the first train the detectors on each train are set in action, and by means of the relaying solenoids mentioned the brakes are applied and both trains are brought to a standstill. This is done entirely without the volition of the engine driver, who would, however, of course, cut off steam directly he felt the brakes go on. In the same way a second train entering a section in the opposite direction to which the first train was moving would also be pulled up, and so head-on collisions would be avoided. The possibilities of the system in preventing occurrences of both these kinds was successfully demonstrated at the Stratford-on-Avon tests.

Automatic time apparatus are employed which come into play immediately current is received on the train or in the signal box. This apparatus also operates by breaking the local circuits. These time apparatus are designed purely to meet railway conditions and to introduce a time element in the case of the station for the signalman to replace his lever before he is recorded for negligence. In the case of the train they also switch the train system over from the receiving condition into the sending condition each time the train enters the main section of track.

A number of apparatus on the right-hand side of the engine cab are each provided with handles at the right of each of these devices. These apparatus are change-over drums, and are only used for the purpose of operating the various gears either at the station or on the train by hand, instead of automatically. In each case they switch off for the time being the automatic circuits and provide the necessary connections for individual apparatus in the system, such as, for instance, ringing a howler on the train from the station, putting on the brake only, or operating the howler and the brake combined, and so forth. At the station they operate the alarm gong from either platform, and the restoring or main sections. These separate hand-controlled switches were merely used for the recent Stratford demonstrations for the purpose of showing some of the purposes of the railophone signaling system.

It will therefore be seen that the "Railophone" system provides in a very complete way for the protection of trains passing through the various sections, and it does this with a minimum of modification in the existing apparatus. For with the exception of the visible and audible signal in the signal box, there would, under ordinary conditions, be no additional apparatus to be attended to by the signalman. It cannot be said either that the employment of this system would encourage slackness on the part of the driver and signalman through their placing blind reliance on the automatic apparatus to perform their duties. On the contrary, the use of this apparatus would tend to increase their alertness, as any inattention or carelessness on their part would be automatically recorded, and in case of accident could be used in evidence against them. Further, its claims to a trial as a means of reducing the dangers of working in foggy weather seem exceptionally strong.

Party Lines Barred

Under its franchise with the city of Louisville, the Louisville Home Telephone Company can not maintain party lines. The Court of Appeals so held in reversing the judgment of the Jefferson Circuit Court in the case of the city of Louisville against the telephone company. The court remanded the case to the lower court with directions to grant the injunction asked by the city.

The Jefferson Circuit Court dismissed an action in equity brought by the city of Louisville to enjoin the Louisville Home Telephone Company from using in its telephone system in the city what is known as party lines. Reviewing the terms of the ordinance and the franchise of the telephone company, the Appellate Court says that it can not be left to the company to alter at will the terms of the contract under which it obtained the franchise, and, at the same time, leave it to determine whether its act in so doing is for the benefit or to the injury of the public.

The court says that it is manifest that the provisions prohibiting the use of party lines was a condition of the contract by which the telephone company acquired its franchise, and that the condition was one the city had the right to impose.

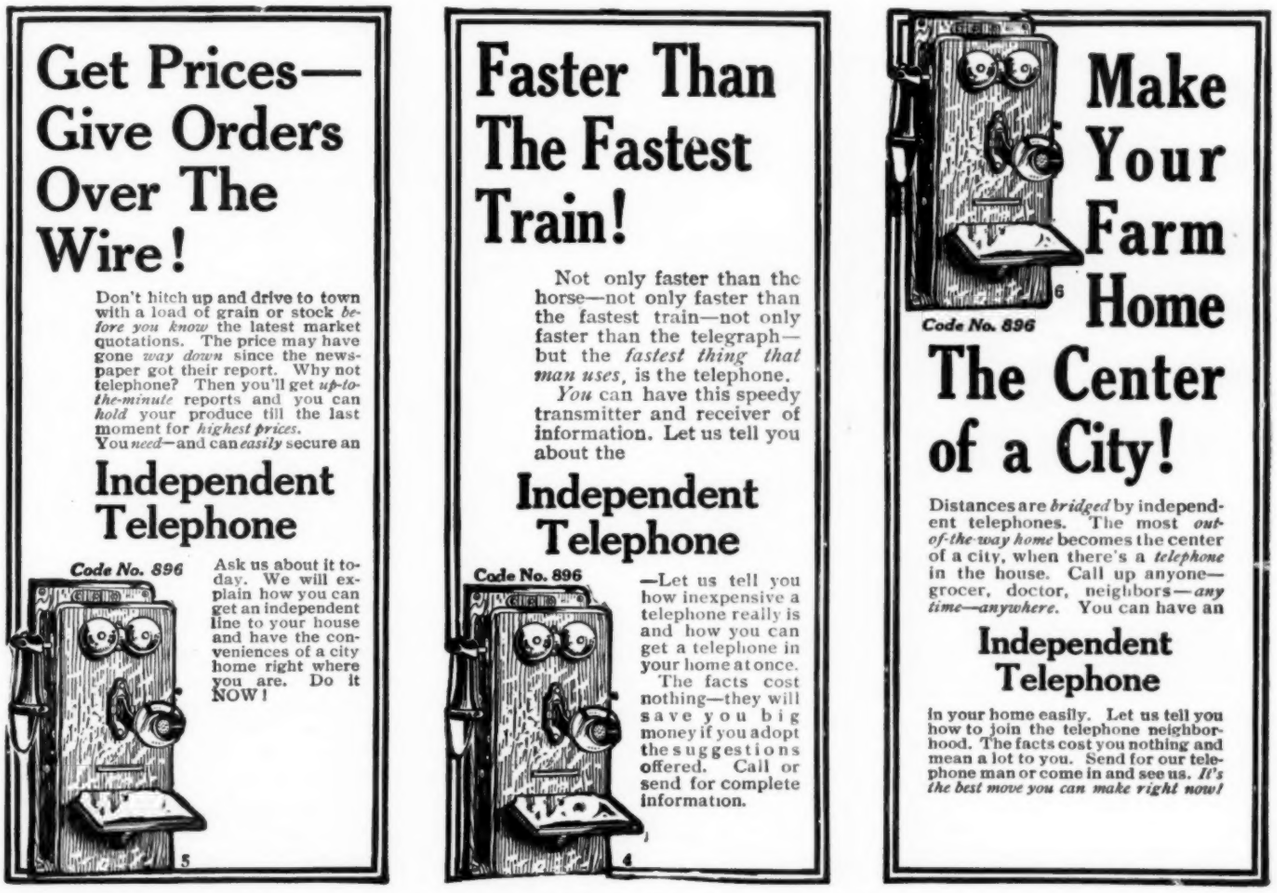
Of Interest to the Trade

By A. L. Haase

Recent Stromberg Publicity

A unique and interesting form of advertising has been devised by the Stromberg-Carlson Telephone Co. for the benefit of the independent telephone exchanges in the smaller towns. By the method adopted by this company, it is possible for the small exchanges to advertise effectively and economically in their local daily or weekly papers, and so popularize the service in their community. The plan of having the trained advertising experts of the Stromberg-Carlson Company furnish the cuts, insert the name of the exchange left in the blank space, and the advertising is ready to print. The accompanying cuts are examples of the electros of this series, which reflect great credit on the writer. As many of the larger newspapers stereotype their type forms, the company is in a position to furnish matrices as well as electrotypes.

Space in the rural publications costs very little, much less than to drive around and call on everybody in the community, even had the manager time to spare for this purpose. Everybody in such a community reads the local


Get Prices—Give Orders Over The Wire!
Don't hitch up and drive to town with a load of grain or stock *before you know* the latest market quotations. The price may have gone *way down* since the newspaper got their report. Why not telephone? Then you'll get *up-to-the-minute* reports and you can *hold* your produce till the last moment for *highest prices*. You *need*—and can *easily* secure an
Independent Telephone
Code No. 896
Ask us about it today. We will explain how you can get an independent line to your house and have the conveniences of a city home right where you are. Do it NOW!
5
Faster Than The Fastest Train!
Not only faster than the horse—not only faster than the fastest train—not only faster than the telegraph—but the *fastest thing that man uses*, is the telephone.
You can have this speedy transmitter and receiver of information. Let us tell you about the
Independent Telephone
Code No. 896
—Let us tell you how inexpensive a telephone really is and how you can get a telephone in your home at once.
The facts cost nothing—they will save you big money if you adopt the suggestions offered. Call or send for complete information.
4
Make Your Farm Home The Center of a City!
Code No. 896
6
Distances are *bridged* by independent telephones. The most *out-of-the-way home* becomes the center of a city, when there's a *telephone* in the house. Call up anyone—grocer, doctor, neighbors—*any time—anywhere*. You can have an
Independent Telephone
in your home easily. Let us tell you how to join the telephone neighborhood. The facts cost you nothing and mean a lot to you. Send for our telephone man or come in and see us. *It's the best move you can make right now!*

Samples of Stromberg-Carlson Publicity Aids for the Operator.

ad. copy relieves the local manager of this work, and at the same times makes it far more effective as a business getter. This service is without cost to the exchange except for the cost of the space in the local paper.

A series of fourteen electrotypes are furnished, each one of which covers a vital reason for the use of the telephone on the farm. When used in their proper order, they lead up to an irresistible climax. If one is used every week, it will take three months to use up the entire set, and by that time they can be started over again in the same order. The local newspaper will take these paper, and the advertisement will be read regularly, and result in increased business. One new subscriber to the telephone service will pay twelve times over for the cost of a five-inch advertising space. Not only is the advertising of benefit to the exchange, but it also strengthens the independent exchange in all communities.

Besides the electros of the advertisement, the company is also prepared to furnish cuts of its equipment for use in printing circulars and booklets, free of charge. It should be remembered that this service is extended not only to the users of Stromberg-Carlson ap-

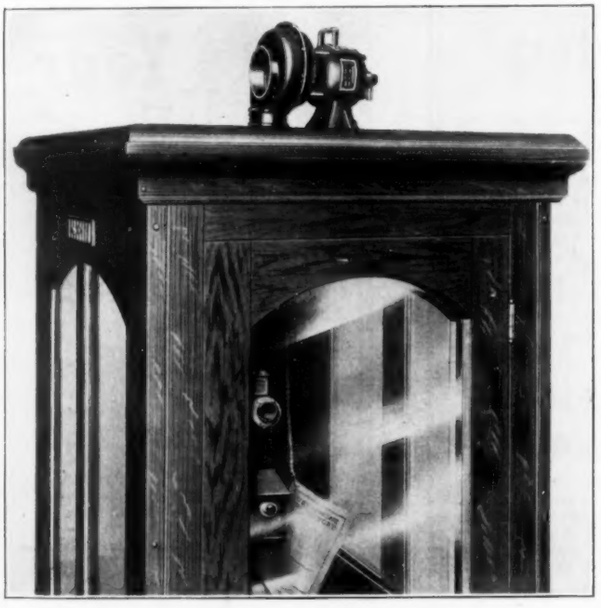
paratus but to all independent companies regardless of the make of their equipment.

As in the past, the Stromberg-Carlson Company will continue its extensive advertising in the leading agricultural papers, both in the United States and Canada.

"The Power of Advertising," a booklet issued by this company, should be of interest to every independent telephone man in the country, for it contains many valuable hints along the lines suggested by the title, and enables him to obtain an extended publicity at small expense.

Sturtevant Booth Ventilator

The Sturtevant patented telephone booth ventilator has been brought out by the B. F. Sturtevant Company, of Hyde Park, Boston, Mass., for the purpose of changing the air in a telephone booth, by blowing fresh air into and supplying exit for the air from the booth. It consists of a fan wheel of the patented Sturtevant multivane type, running inside a casing of pressed steel, and directly connected to



Sturtevant Booth Ventilator in Use.

an electric motor, fan-casing and motor being securely fastened together. Mounted upon felt pads on the top of the telephone booth, the ventilator blows air into the booths, while special slide-gates set in the walls of the booths allow the air to escape from it.

The air blown into the top of the booth is admitted through a short pipe, made of fibre, and is prevented from striking directly upon the head of the occupant, by a deflector. One slide-gate is placed at the bottom of the inside wall of the booth, and the other in the top of the outside wall, so that air leaves the booth at the bottom, passes through the dead air space between the two walls, and goes out at the top. With booths having in-swinging doors, there is so much leakage that no slide-gates are necessary.

The cost of operating an electric telephone booth ventilator is very slight, and even this may be stopped when the booth is not occupied, if desired. Careful design and construction make the operation of the ventilator almost noiseless. The telephone booths in the North Station at Boston, Massachusetts, were equipped with ventilators last year and have been so successful, that all the booths in the South Terminal Station in the same city are being equipped this year.

Numerous hotels and clubs, appreciating the value of this ventilating device, have installed it in their telephone booths.

Making Copper Clad Wire

Since 1860 attempts have been made to form a satisfactory electrical conductor by welding together copper and steel. It was not until after 1902 that a satisfactory process was discovered, in which year John Ferrel Monnot who had devoted many years experimenting with various processes, came from France to this country. In November, 1905, the Duplex Metal Company was organized and incorporated to manufacture copper clad wire under a process developed by Mr. Monnot. The first wire was manufactured at Chester, Pennsylvania, in an old rolling mill, which was afterwards purchased by the company. This mill has since been replaced by an up-to-date fireproof structure, having an annual capacity of over 25,000,000 pounds of wire.

In the manufacture of the wire, pure copper is welded to steel through intervening layers of iron-copper alloys. The description of the process used for making the wire is most interesting. Steel billets are rolled to a bar, which is cut into other billets. These are then passed to a machine, where the ends are drilled and tapped. After pickling and washing, the billet is heated to a given temperature and drawn up into a mold (also previously heated), by means of a rod, screwed into one end. This rod slides up and down in the center hole of a three-jawed chuck which holds the mould, and centers the billet in it. The mould and billet are now carried to a furnace of special design, which contains molten copper at a very high temperature. The billet is lowered out of the mould and into this copper, and kept there for a time sufficient to form an alloy on the surface of the steel. It is then drawn up into the mould and the whole carried to a second furnace containing the purest of commercial copper.

This copper is poured into two openings in the top of the mould (the bottom of which is closed by a flange) and unites the alloyed area and fills the mould. When the copper has set, the chuck and rod are unscrewed, and the copper clad billet taken out of the mould, after the necessary preliminary heating it is rolled to any desired size or shape. The wire used with or without insulation is always drawn so as to obtain the highest possible tensile strength. The drawing of the wire is carefully supervised so as to produce the best wire possible. Since the introduction of copper clad wire, careful tests, both in laboratories and in actual service, have been made. The information derived from these tests has been carefully tabulated and the various factors upon which telephone transmission depends, can be found in a very interesting handbook just issued by the Duplex Metals Company, of Chester, Pennsylvania.

This handbook is of great interest to telephone

and telegraph men, as it contains much useful and valuable information about a wire which has so rapidly come into favor as an electrical conductor.

Matthews Cable Clips

A small circular has been issued by W. N. Matthews & Brother, 3722 Forest Park boulevard, St. Louis, Mo., describing their well-known cable clips, cable rolls, splicing joints, and guy anchors. No tools are required for the installation of the Matthews clip, and it affords a separate grip both on the cable and on the messenger. Each clip will stand a load of well over 100 pounds, and the distance between the cable and the messenger does not exceed one inch and a half.

Among the companies placing recent orders, are the Mexican Telephone and Telegraph Company, who have ordered over half a million of the clips, and two Texas companies who have each ordered the same number.

New Western Transmitter Arm

A recent development in the field of telephone apparatus and accessories is the Western Electric No. 47 type transmitter arm. This arm is of the folding or "ferry-gate" type, and is furnished in three different styles so that it may be placed on top of a flat-top desk, on the wall, the side of a flat top desk, or on the side of a roll-top desk.

The design is such that it may be used with any

A Folding Transmitter Arm.

desk telephone by means of a clamping device at the end farthest from the pedestal. The use of the new transmitter arm is recommended for those telephone users who already have a desk set and find that they either habitually throw the set off the desk or else have trouble in keeping the cord and stand from becoming entangled with their papers.

Klein's Cableman's Saw

A new double-edged saw has been introduced by Mathias Klein & Sons, Chicago, that is specially arranged for cable work. One side has coarse teeth for cutting through the lead cable sheath, while the other edge has finer teeth for cutting through the wire core.

The saw blade is made of silver steel, with an apple-wood handle fastened to it with three brass screws passing through the handle and blade, terminating in brass flush nuts on the opposite side. The length of the blade is 14 inches, and the overall length 18 inches. The saw, while primarily intended for cable cutting, will cut wood also and will prove a handy tool for those working with cables.

Efficiency Society Prospectus

The Efficiency Society, 29 West 39th street, New York City, has favored us with a prospectus containing information regarding its plans and progress. Organized March, 18, 1912, for the purpose of promoting efficiency or percentage of result obtained relative to the effort expended in every activity of man, in all forms of business and industrial pursuits, the society has attracted the attention of the leading men of the country.

The membership is growing continuously, united by the common purpose of securing and disseminating such information as will result in individual and general efficiency.

The society is the natural outgrowth of modern tendencies in all forms of business, industrial, professional and social life. Owing to the rapid development of civilization with its multiplication and specialization of activities, the demand for capable leaders and executives has far exceeded the supply, and many men have had great supervisory responsibilities thrust upon them which they could not from the nature of their education or experience be capable of meeting. Some of these men, unaware of the fundamental principles of organization and management, have imposed upon their subordinates their self-devised methods, and when the latter did not meet with favor forced their adoption.

Compulsory methods always arouse resistance and resentment. This is evidenced in the unsatisfactory relationship which has developed between the employer and employee. For several years private firms and individuals have realized the necessity for improving this situation and thus increasing efficiency on the part of these two elements. They have been attempting to do this by what they have conceived to be a fairer treatment of the employee, and by standardizing operations, eliminating useless motions and preventing wastes.

Efforts also have been made by Universities and local associations to educate executives in better methods of organization and management. Bureaus of municipal investigation have devoted no little scientific research and analytical thought to the efficiency question. Very recently popular attention has been focused upon it by important public utterances and discussions. Through these means has come a recognition of the validity of the sciences of organization and management, the former as important as the latter, although comparatively little is heard of it.

These sciences, however, are still to be properly formulated and correlated. The accomplishment of such a task demands a society of broad scope and inclusive purpose—a society of national extent. Only by a large body of individuals associated in this way can satisfactory progress be made in the development of the new sciences that are of so vital interest to every man in the world of affairs.

In the summer of 1911 the task of organizing such a society was begun by a few men in New York. The movement grew by accretion through nominations by its members, and late in the fall an organizing committee of one hundred and thirty men was gathered. Among them were business executives from every field, public accountants and systematizers, industrial engineers, economists, educators, legislators and government officials.

This committee formed the nucleus of the society. During the first two months of 1912 the plans of the society were definitely formulated. They were simple, but comprehensive. Briefly, they proposed that the efficiency society should provide a common meeting ground where men who realized the value of efficient methods of accomplishment could become acquainted and exchange ideas. Such a society could not consider simultaneously every field of human enterprise, but it proposed to take up one field at a time.

The society has in hand a program following up the work initiated at its first meeting and intended to develop the sciences of organization and management in ways that will lead to efficiency in the industrial and other fields. This program will be a dual one, in part curative of present inefficiency and in part preventive of inefficiency in the future. Simultaneously with this program the actual situation will have to be carefully studied and for this purpose a canvass will be made to find out the causes of inefficiency existing in each of a great many enterprises and to note the results of the efforts which have been made to correct it.

In the fall these data will be presented at a conference which will be attended by the deans of the colleges and universities throughout the country which have established courses in commercial and business administration, and an effort will be made there to harmonize and standardize these courses and to embody in them the proper information which will not only qualify the future employer for his work, but will also better equip men to do reorganizing and systematizing work in offices and factories and to modernize the methods of present employers. This conference will be addressed not only by men who have been successful in the various fields of human activity, but by the graduates of these schools who will say whether the present curricula have been of value in their practical work, and suggest changes accordingly.

A New Rope Clamp

A patent has just been issued (No. 1,027,234) to W. E. Belcher on a special rope clamp that will be manufactured by Hubbard and Company, Pittsburg, Pa. This device consists of an elongated link and a bolt, either "U" or "J" shaped. The strand is gripped on all sides between rounded surfaces and is at the same time held away from the steel supports to avoid injury to the strands. This attachment is particularly adapted for attaching transmission ground wires to bayonet angles or steel towers.

Automatics for Des Moines

An order for a complete automatic telephone exchange with a capacity of 20,000 telephones, for installation in Des Moines has been placed by Henry Riegelman with the Automatic Electric Company of Chicago, manufacturer of the automatic equipment.

This announcement was made recently by Mr. Riegelman when he returned from Chicago and Grand Rapids, where he spent about two weeks inspecting automatic exchanges.

"We will not be able to get our equipment before July 1, 1913," said Mr. Riegelman. "The company when it accepted my order stated that it would take at least a year to supply Des Moines as there are so many orders ahead, for it seems that many large cities are installing the automatic systems as fast as the equipment can be manufactured. Our first order is for 10,000 telephone instruments, but the board will be capable of handling 20,000 connections and we will order more instruments as fast as the exchange gets subscribers."

Mr. Riegelman is more enthusiastic over the automatic telephones since his visit to Chicago and Grand Rapids. He says that "the system is so far advanced over the old manual system formerly in use here that there is no comparison.

"We had a test of the two systems in Chicago," said Mr. Riegelman. "I was not familiar with the use of the automatic system so they selected me to call up six persons to ascertain the time required to get a connection. Without any experience I operated the system and got my parties in an average of six seconds per call. It is impossible to make a mistake on the automatic."

Mr. Riegelman states that he has applications from the owners of 200 toll lines in Iowa alone who want to get connections with Des Moines.

New York Commission News

The New York Public Service Commission, second district, has ordered the New York Telephone Company to discontinue the use of the word "telegram" as a call word for the Western Union Telegraph Company or for any other telegraph company within the state. The New York Telephone Company is directed and required to assign to the Postal Telegraph-Cable Company and Western Union Telegraph Company call numbers as is usual with other subscribers to its service, and that in addition thereto the word "Postal"be assigned as a call word for the Postal Telegraph-Cable Company and the word "Western Union" be assigned as a call word for the Western Union Telegraph Company. The call word for each company is directed to be printed in the subscribers' directories of the telephone company hereafter issued in such manner and with such explanation as to show clearly that a person desiring to send a telegram over the lines of the Postal Telegraph-Cable Company may call that company by the use of the single word "Postal" and that a person desiring to send a telegram over the lines of the Western Union Telegraph Company may call the company by the use of the words "Western Union." The telephone company is required to make a rule for the government of its switchboard operators that in no case shall the word "telegram" be recognized as a call word and that if such word be used the operator shall at once inform the person calling that it is not recognized as a call and that the operator must require the person calling to use a proper call word. The order further provides that in no case of call for telegraph connection shall any employee or switchboard operator of the telephone company be permitted or allowed to designate, direct or advise which telegraph company shall be called for the purpose of sending a telegram, subject, however, to the provision that where the exchange has direct connection with but one company, the operator may advise the person calling what company is connected with that

particular exchange. The making of this order followed the filing of a complaint by the Postal Telegraph-Cable Company alleging that the use of the word "telegram" as a call word operated to a disadvantage of the Postal Company, and that the practice was unjust, unreasonable and discriminatory to it. The resolution of the commission recites that the evidence given satisfied the commission that the use of the word "telegram" as a call word is unjust, unreasonable and discriminatory as against the Postal Telegraph-Cable Company.

The commission has received notice that the New York Telephone Company has purchased the physical property and business of the Onondaga Independent Telephone Company for the sum of $700,000. This property was consolidated with the New York Telephone Company June 30, 1912, except that Tully and Liverpool were consolidated about May 1, 1912. Also the Albany Home Telephone Company's physical property and business in the county of Greene for the sum of $50,500 subject to existing mortgages; the physical property and business of the Baldwinville Telephone Company for the sum of $13,100; the physical property and business of the Newburgh Home Telephone Company for the sum of $11,800; the physical property and business of the Home Telephone Company of Frewsburg, Chautauqua county, in the sum of $8,000 and the physical property and business of the Deposit Home Telephone Company of Deposit, Broome county, for the sum of $6,100.

The companies sold have ceased to do business and the New York Telephone Company now carries on the business formerly conducted by them.

The commission has been notified that the Southern Cayuga Telephone Company has been merged with the Cayuga Southern Telephone Company. The Cayuga Southern Telephone Company now owns all of the stock of the Southern Cayuga Telephone Company.

Western Electric's Half Year

Returns for June complete the first half calendar and fiscal year for the Western Electric Company. Total of goods billed out during that period run close to the company's official estimate, made when the year was not two months old and which was that 1912 would show a total of approximately the same as 1911's total of $66,000,000 gross business. Goods billed out during June were ten per cent more than for that month a year ago, which makes this year's six months aggregate of gross sales two per cent ahead of the corresponding six months in 1911. The ten per cent increase for June is like the abnormal increase of seventeen per cent shown in April, and is due to special circumstances. It does not mean that affairs are improving as rapidly as indicated by last months' returns, the six months total being a better criterion of how the Western Electric is progressing. Fluctuations by months in the company's business have been considerable this year to date. January and February were respectively nine per cent and two per cent behind the same months in 1911, March ran about even with the preceding March, April showed a gain of seventeen per cent. May a falling off of three per cent and June an increase of ten per cent. The gain last month, came mostly from America and was widely distributed, so that it cannot be attributed to special conditions prevailing in any one section of the country.

Kentucky Commission News

The Kentucky Railroad Commission has voted to allow the consolidation of the Cumberland Telephone and Telegraph Company, Hopkinsville Home Telephone Company, Pembroke Home Telephone Company, and the Todd County Home Telephone Company, which companies operate and maintain telephone systems in Christian and Todd counties, and which will be known as the Christian-Todd Telephone Company. The commission met at the Seelbach. Statements and evidence of representatives of the telephone companies and the municipal officials and commercial bodies of several cities were heard. In granting the privilege of consolidation the members of the commission discussed at some length the act of the legislature approved March 13, 1912, by the governor. They contend that certain portions of it are in conflict with Section 201 of the state constitution, the new law permitting of wider range in consolidation than the constitution. They also declare that "there is no tribunal in the state charged with the power or authority to regulate the service and charge of toll lines and that many municipalities have, either through carelessness or neglect, failed to protect their respective localities under the provision of the franchise sold to the telephone companies, therefore it would be nothing short of a public calamity for the Railroad Commission to privilege wholesale consolidation of the independent telephones in Kentucky without some reasonable restrictions." Acting in accordance with these views, the commission in passing the resolution favoring the consolidation of the Western Kentucky companies does so provided that the consolidated company, the Christian-Todd Telephone Company, shall not charge, collect nor receive a greater sum of toll or compensation than that sum which is now charged, collected or received by the constituents corporations for the same or similar services hereafter rendered, so long as said companies operate as a consolidated company, by the resolution of the commission under substantially the same circumstances as now exist.

Sulphated Plates

If storage battery plates in an uncharged condition are left standing in the electrolyte for any length of time, the acid in the solution will attack the active material in the plates, and combine with it, to form lead sulphate. As lead sulphate has a high resistance, and is insoluble in the electrolyte, the sulphate will reduce the output of the cell by partially insulating the plates from the electrolyte. Excessive deposits of lead sulphate will cause the destruction of the cell. This process is known as "sulphating," and it is a very common disease of the storage battery. The sulphate appears as a white coating on the surface of the plates.

Gradolph Company Moves

The International Gradolph Electric Company, St. Louis, Mo., announces its removal from its old location at 800 Chestnut street, to 913-914 Chemical building, St. Louis, Mo.

Brevities of the Business

PERSONAL NOTES.

H. C. Slemin, advertising engineer of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has moved from 840 Harvard street, Rochester, to his new residence in Brighton, a suburb. The house stands on Highland avenue, near Monroe avenue, facing southeast and is, we are reliably informed, really some house.

Gilbert Gislasen, who recently joined the Stromberg-Carlson staff as cost manager, was so unfortunate as to require an operation for appendicitis almost as soon as he reached Rochester. He is now well on the road to recovery, however.

J. G. Ihmsen, the new general manager of Stromberg-Carlson, returned to Chicago for a few days last week.

Fred B. Butt has been appointed chief clerk and claim agent of the Nebraska Telephone Company for Western Nebraska, with headquarters at Grand Island. Previous to the taking over of the Nebraska Telephone Company by the Lincoln Telephone and Telegraph Company, Mr. Butt was manager of the company at Nebraska City.

M. A. Sanders, manager of the Pioneer Telephone Company at Tulsa, Oklahoma, for the past three years, has been appointed division superintendent for the company in the southeastern portion of the state. He will be succeeded by C. J. Castleberry, manager at Bartlesville.

Fred R. Mott, formerly general manager of the Bell Telephone Company of Missouri, has opened an office as consulting engineer. His address is the Chemical building, St. Louis, Mo.

J. A. Hebert, until recently manager of the Cumberland Telephone and Telegraph Company's exchange in Spencer County, Indiana, has been appointed plant supervisor for the Evansville district of the company.

Samuel J. Jones has been appointed manager of the Mountain States Telephone and Telegraph Company's office at Ogden, Utah, succeeding W. F. Madson, who will act as personal representative of C. G. Seelye, general manager of the western division. Mr. Jones was formerly manager of the Nephi district of the company.

V. E. Crain is now manager of the Douglas Telephone Company's office at Assumption, having been transferred from the company's office at Homer.

Dean T. Smith, who for the past two years has filled the position of manager of the Nebraska Telephone Company at Central City, most acceptably, has been transferred to McCook. The change is in the nature of a promotion to Mr. Smith, as he will have a larger territory under his supervision. He will be succeeded by B. L. Edwards, of Kearney.

A. Von Schlegell, of Chicago, general commercial superintendent, has been appointed general manager of the Michigan State Telephone Company, with headquarters in Detroit. B. W. Trafford, formerly second vice-president of the company, has resigned to accept the position of vice-president of the First National Bank of Boston. The company is making various changes, with a view to having a general manager in every district.

H. O. Seymour has become general manager of the Wisconsin Telephone Company, and will be located at the general offices of the company in Milwaukee. About a year ago the central group of Bell Telephone companies operating in the states of Michigan, Illinois, Ohio and Indiana, so arranged their organization that the officials who were most expert in the various branches of the business were brought together in a central organization at Chicago. These men were to develop the best telephone methods and practices found in the various states in order to build up the most efficient organization possible by standardizing methods, standardizing practices and enabling the companies to better care for the increase in business which the telephone industry had been enjoying for the past few years. Out of this central organization has developed this new plan. It was decided that greater efficiency in administration could be secured by an organization which places an executive in charge of a company having supervision over the various departments, rather than its various department heads report to specialists in their departments at Chicago, as during the past year. Necessity for close connection with commission and other governing bodies favors this plan.

H. G. Hurd, sales engineer in the New York office of the Standard Underground Cable Company for some time past, has been appointed assistant to the sales manager of the company's Canadian office. His headquarters will be at Hamilton, Ontario.

William H. Marsh, superintendent of construction for the Standard Underground Cable Company, Pittsburgh, Pa., has been appointed secretary, assistant treasurer and sales manager of the company's Canadian branch, with headquarters at Hamilton, Ont.

M. S. Allen, formerly the Western Electric Company's manager at Omaha, has been appointed telephone sales manager of the Northern Electric and Manufacturing Company, with headquarters at Montreal.

W. H. Maberry has been appointed local manager of the Mississippi Telephone Company's exchange at Carthage, Illinois. M. D. Young, of Odell, Nebraska, has been appointed local manager of district No. 1 of this company and is located at West Point, Ill.

R. L. Barry, general superintendent of the Tri-State Telephone and Telegraph Company, St. Paul, Minn., has been appointed commissioner of the Manitoba government telephone system, with headquarters at Winnipeg, Manitoba.

C. H. Adams, state superintendent of the New England Telephone and Telegraph Company for Maine, recently died at Limerick, Maine.

Bernard W. Trafford, for nineteen years connected with the American Telephone and Telegraph Company and allied interests as manager of various Bell properties throughout the country, has been elected vice-president of the First National Bank of Boston.

Mark Mellor, who has been connected with the New York Telephone Company, with headquarters at New Rochelle, will assume the position of special agent for the Chesapeake and Potomac Telephone Company, with headquarters at Baltimore, Maryland. The position Mr. Mellor will fill is a new one in the telephone service. He will engage in field work, staff work and office work, and will also be engaged in organizing new methods in the commercial side of the business.

C. E. Wilde, for a number of years division manager of the Grand Rapids district of the Michigan State Telephone Company, will resume his old position at Grand Rapids, while George R. Heywood, who succeeded him as district commercial superintendent, will return to Detroit and resume his old position as commercial agent.

A. W. Selander, local manager of the North Dakota Telephone Company at Bismark, will go on the road as right of way man for the company, and will be succeeded as manager at Bismark by Frank Keenan.

C. C. Campbell, district manager of the Mountain State Telephone and Telegraph Company, at Cheyenne, Wyoming, has been promoted to the position of special representative of the president, E. B. Field, in the general offices of the company in Denver. Mr. Campbell will represent the president in all parts of the company's territory where the presence of the president himself is desired, but not always possible. C. T. Hopkins, manager at Pueblo, Colo., will succeed Mr. Campbell in his present position.

H. B. Lidstone, who for some time has been cashier of the Fargo exchange of the Northwestern Telephone Company at Fargo, has been promoted to the management of the company's exchanges at Wahpeton and Breckenridge. The promotion of Mr. Lidstone is a much deserved one. He has been with the company for some time and has gained a reputation for his faithful discharge of duty.

C. M. Kelley, of Hornell, N. Y., has assumed his duties as district manager of the Niagara County Home Telephone Company. He is located at Niagara Falls and has supervision over the company's business in Niagara County and the city of Tonawanda in Erie County, succeeding R. Max Eaton, of Niagara Falls.

NEW TELEPHONE COMPANIES.

WEDOWEE, ALA.—The Wodley Telephone Company has been incorporated with a capital stock of $2,000 by J. M. Welch, R. W. Thompson, H. L. Simpson, C. G. Croley, H. D. Pearson and others.

CHALKVILLE, ALA.—The Mutual Telephone Company has been organized with a capital stock of $2,000 and the following officers: President, W. R. Rich; vice-president, J. D. Carlisle; secretary and treasurer, T. W. Franklin, all R. F. D., Birmingham.

HAMPTON, ARK.—The Hampton Telephone Company has been incorporated by H. C. Clark, W. R. Fea and C. C. Mason; capital stock, $10,000, of which $4,000 is subscribed.

CLARKSVILLE, ARK.—The Johnson County Telephone Company has been incorporated with a capital stock of $15,000, by Edward Cronk, C. J. Farnsworth and S. H. Logan.

SAN MIGUEL, CAL.—The San Miguel Interurban Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are T. H. Rouquet, W. M. Sitton, W. A. Millmar, San Miguel; H. H. Durham and L. F. Van Horn, Parkfield.

STRATHMORE, CAL.—Thirty ranch and orange grove owners have formed the Magnolia Telephone Association, of which N. A. Clifford is president and H. M. Stutzman, secretary and treasurer.

DOVER, DEL.—The Metropolitan Telephone and Telegraph Company, of New York, has been incorporated with a capital stock of $3,000,000. The incorporators are: C. A. Stillman, New York City; H. Lee Sellers, Montclair, N. J.; Reynolds Clough, Dover.

WASHINGTON, ILL.—The Washington Home Telephone Company has been incorporated to construct and maintain a telephone system in Washington and community. The capital stock is $45,000, of which $15,000 is preferred and $30,000 common stock. The following have been chosen directors for the first year: A. P. Armington, Folger Adam, C. F. Hallforth, George B. Carey, A. G. Hawley, T. A. Cheadle and Albert Stickel. C. A. Camp and C. B. Cheadle are also interested in the new organization.

ST. PETER, ILL.—The St. Peter Telephone Company has been incorporated with a capital stock of $1,000 to do a general telephone business. The incorporators are C. F. Bochtler, Fred Engelken-John, George Hassebrock, Louis Ambuehl.

ELIZABETHTOWN, ILL.—The Elizabethtown Mutual Telephone Company has been incorporated by R. H. Willingham, Wiley Lavender and Abram Lawrence, with a capital stock of $2,000.

CHICAGO, ILL.—As a part of the reorganization of the Illinois Tunnel Company the Illinois Telephone and Telegraph Company has been incorporated with a nominal capital stock of $5,000 by S. W. Tracy, J. W. Callahan and M. B. Auger.

NEW MINDEN, ILL.—The New Minden Telephone Company has increased its capital stock from $2,490 to $5,000.

LYNN, IND.—The Lynn Local Telephone Company has been incorporated with a capital stock of $50,000 to supply telephone service to the towns of Lynn, Carlos, Modee, Lesantville, Parker, Farmland, Winchester, Union City, Spartansburg, Crete, Fountain City, Bethel, Whitewater, Richmond, Greensfork, Hagerstown, Williamsburg, Economy, Centerville, Hollansburg, Glenhark, Palestine, Greenville, Rowan and others. The directors are S. C. Bowen, J. S. Blair and W. R. Holliday.

CLAY CITY, IND.—The Clay City Mutual Telephone Company has been incorporated by C. W. Hurst, John Middlemas and S. L. Royer, with a capital stock of $10,000.

OBERLIN, KAN.—The Consolidated Telephone Company has been incorporated with a capital stock of $150,000. The officers are: A. S. Steele, president; W. T. Stevenson, vice-president; H. O. Douglas, secretary; Otis L. Benton, treasurer. The company covers Norton, Decatur, Rawlins and Thomas counties and a part of Sheridan County. It is the purpose of the organization to give better service in the counties covered and put a telephone in every business house and residence.

DALTON, KY.—Articles of incorporation have been filed for the Dalton Telephone Company by F. C. Sisk, L. B. Sisk, B. G. Brown, G. B. Hale, S. D. Wilson and B. D. Brown; capital stock, $1,000.

HOPKINSVILLE, KY.—The Christian-Todd Telephone Company was recently incorporated with a capital stock of $1,000,000, and has elected the following officers: President, R. E. Cooper; general manager, D. Gordon Edwards; secretary, Frank G. Hoge. It is stated the new company will take over the properties of both the Cumberland Telephone and Telegraph Company and the Home Telephone Company. Physical connection between the two plants will be made and they will be run as one system.

NUCKOLS, KY.—The Farmers' Mutual Co-operation Telephone Company has been incorporated by W. M. Humphrey, J. D. Vance, A. H. Lee, and others.

SPRING VALE, MINN.—The Walbo Rural Telephone Company has been incorporated with a capital stock of $9,900 by A. Saterlund, Gust A. Larson, S. O. Wicklund, John W. Gradin and others.

PARKER'S PRAIRIE, MINN.—The Eastern Farmers' Telephone Company has been organized with a capital stock of $9,000. The officers of the company are: W. H. Smith, president; A. B. Rosenquist, secretary.

RULEVILLE, MISS.—J. M. Riddell, J. M. Jones and T. B. Brown have incorporated the Burl Telephone Company with a capital stock of $5,000.

HEUVELTON, N. Y.—The Heuvelton Telephone Company has been incorporated with a capital stock of $20,000 by W. L. Wainwright, N. Wainwright and W. H. Mulholland.

DEKALB, N. Y.—Articles of incorporation have been filed for the Maple Ridge Telephone Company; capital stock, $3,000. The incorporators are Ervin Streeter, Horace T. Streeter and Donald N. Ritchie, all of DeKalb.

TOWNER, N. D.—The Alfalfa Valley Telephone Company has been incorporated by E. C. Sargent, S. W. Wheelon, and T. J. Cummings, with a capital stock of $25,000.

KINGSVILLE, O.—The Kingsville Telephone Company has been incorporated with a capital stock of $10,000 by C. S. Whelpley, R. A. McGreen, F. M. Booce, F. C. Reed, F. G. Howard, E. J. Hines and W. S. Childs.

ELMWOOD, OKLA.—The South Flat Telephone Company has been incorporated with a capital stock of $2,000 by T. S. Pinnell, P. J. Hiebert and John Strague, all of Elmwood.

HYDRO, OKLA.—The South Canadian Mutual Telephone Company has been incorporated by S. N. Hosey, E. S. Lipscomb and J. D. Norris; capital stock, $500.

SCRAPPOOSE, ORE.—The Columbia County Telephone Association has been incorporated by H. West, G. B. Milloy, J. G. Watts and others; capital stock, $5,000.

KRATZERVILLE, PA.—The Dry Valley Telephone Company has been incorporated with a capital stock of $5,000.

GRAMPIAN, PA.—The Grampian Hills Telephone Association has been incorporated with a capital stock of $5,000. James Miller and others are the incorporators.

BRUNNERSVILLE, PA.—The Elizabeth and Warrick Telephone Company has been incorporated with a capital stock of $5,000.

PINEWOOD, S. C.—The Pinewood Telephone exchange has been incorporated with a capital stock of $1,000 by Walter D. Epperson, J. W. Weeks, R. C. Richardson and others.

LAUDERDALE, TENN.—The Union Telephone Company has been incorporated with a capital stock of $500.

NEVASOTA, TEX.—The Yarbrough Telephone Company has been incorporated with a capital stock of $6,000 by G. C. Stoneman, I. M. McGinty and R. N. McGinty.

DALLAS, TEX.—The Monarch Telephone Manufacturing Company of Fort Dodge, Iowa, has been granted permission to do business in Texas, with headquarters at Dallas; capital stock, $150,000.

TROUTLAKE, WASH.—The Farmers' Union Telephone Company has been organized and will be incorporated with a capital stock of $50,000.

FINANCIAL NOTES.

FORT DODGE, IA.—The capital stock of the Fort Dodge Telephone Company has been increased from $100,000 to $300,000.

RICEVILLE, IA.—The Farmers' Telephone Company has increased its capital stock from $9,000 to $25,000, to enable it to take over the Riceville exchange.

MINNEAPOLIS, KAN.—The capital stock of the Rural Telephone Association will be increased from $6,000 to $28,000.

LEITCHFIELD, KY.—The capital stock of the Yeaman Mutual Telephone Company has been increased from $1,000 to $5,000.

AUGUSTA, ME.—The Northern Maine Telephone and Telegraph Company has doubled its capital stock, increasing same from $10,000 to $20,000.

BURR OAK, MICH.—The Southern Michigan Telephone Company will issue $500,000 fifteen-year 6 per cent bonds, part of which will be used to cancel outstanding obligations and part will be used for extensions and improvements.

BARNSTEAD, N. H.—With a view to extending its lines the Union Telephone Company has increased its capital stock $1,000.

NORTH JACKSON, O.—The North Jackson Telephone Company has increased its capital stock from $10,000 to $25,000.

CLEVELAND, O.—The Cleveland Telephone Company has filed its inventory with the state public utilities company at Columbus. The company contemplates increasing its capital stock from $3,100,000 to $4,000,000 and the commission required the inventory before it would pass on the request to allow the company to raise its capital stock. The company is planning to lay additional cable.

OTTAWA, O.—The Putnam Telephone Company has increased its capital stock from $110,000 to $125,000.

ALGOOD, TENN.—The charter of the Algood Home Telephone

Company has been amended, increasing its capital stock from $500 to $1,500.

OMAK, WASH.—The capital stock of the Farmers' Telephone Company has been increased from $2,000 to $3,000.

FRANCHISES ASKED AND GRANTED.

DES MOINES, IA.—The granting of a franchise to a mutual telephone company to install an automatic telephone exchange will be put before the people of Des Moines at the election to be held in November. According to the Des Moines plan of government, franchise rights can be given only by the people. According to Mr. Riegelman, the promoter, the cost of installing the new system will be about $2,000,000. The wires are to be placed underground and the system will be up to date in every particular.

HYATTSVILLE, MD.—At a special election, held recently, an unlimited franchise was granted the Chesapeake and Potomac Telephone Company. The company agrees to remove practically all its poles from the streets within four years. It is also proposed to install the latest system in this place. About $10,000 will be spent in placing the wires underground and in erecting a new exchange building.

WAYLAND, MICH.—A number of telephone subscribers in this place have signed an agreement pledging themselves to discontinue the use of the Bell telephones in case the company does not rescind its order increasing the rates, and local capitalists are considering establishing a co-operative telephone company.

WEST BRANCH, MICH.—The attempt to raise telephone rates in this place has met with considerable opposition and a local company may be formed.

MCCOOK, NEB.—The City of McCook is demanding a reduction of 33 1-3 per cent in the present rates of the Nebraska Telephone Company. The present rates are as follows: Business telephones—individual, $3; two-party lines, $2.75. Residence—individual, $2; two-party, $1.50. McCook has never had any competition in the telephone business and for this reason it is claimed rates have been held up higher than in other cities of the same size.

CHADRON, NEB.—At the request of the Chadron Telephone Company, the state railway commission has issued an order increasing the monthly rental of individual business telephones from $2 to $2.50. A central energy system being installed at Chadron is the reason for the increase.

COLUMBUS, O.—The patrons of the Clinton County Telephone Company have filed a protest with the state public service commission against the new rates proposed by that company, claiming that it would mean in the aggregate about $18,000 a year more for their telephone service without any benefit. The Union County Telephone Company has asked permission to buy the property of the Central Union Company in that county.

SPARTANBURG, S. C.—The hearing of the Spartanburg telephone rates situation by the railroad commission has been set for September 12.

MITCHELL, S. D.—The Dakota Central Telephone Company has been granted permission to lower its rates on a two-party line in this city from $1.50 to $1.25 per month.

BRODHEAD, WIS.—Authority to increase the rates for residence telephones from $1 to $1.25 per month has been granted the Brodhead Telephone Company by the rate commission.

MISCELLANEOUS.

RED BLUFF, CAL.—At the annual meeting of the Tehama County Telephone Company the following officers were elected: President, J. J. Worthington; vice-president, E. L. Sisson; secretary and treasurer, H. P. Andrews; directors, the above officers and J. P. Taft, James McCampbell, G. W. Freemyers and G. W. Million.

LEWISTON, IDAHO.—The Inland Telephone and Telegraph Company, recently incorporated at Spokane, is planning to construct lines between Spokane and this city, at an estimated cost of $125,000. Connection will be made with the Nezperce and Co-operative Telephone Company.

AURORA, ILL.—The Interstate Telephone and Telegraph Company, which has for some time been in the hands of a receiver, has been discharged from bankrupty and L. C. Griffiths, of Louisville, Ky., has been appointed manager. Previous to the issue of the order relieving the receivers a certified check for $175,000 was paid into the court to pay the accumlated interest on the bond issues of the company, in default of which the company was declared insolvent. The company has been taken over by an Ohio syndicate, of which E. J. Marshall, of the firm of Marshall and Frazer, attorneys, 1904 Spitzer building, Toledo, Ohio, is president; George W. Wallbridge, vice-president; E. H. Cady, secretary and treasurer.

JOLIET, ILL.—Possibility of the installation of the automatic telephone in Joliet is the result of the confirmation by Judge Kohlsaat, of the United States Court, of the reorganization plans of the Inter State Independent Telephone Company. A general improvement in all the exchanges and toll lines is assured beginning at once.

INDIANOLA, IA.—The Hawkeye Telephone Company contemplates the expenditure of about $6,000 in improving its local system.

IOWA CITY, IA.—The Wagner Telephone Company has been changed to a joint stock company, of which Robert Jones is president and William Berke secretary. The company will improve its local system.

DES MOINES, IA.—Henry Reigleman is behind a movement to install an automatic telephone system in Des Moines by July, 1913.

GIRARD, KAN.—The Cherokee telephone exchange has been purchased by George W. Crawford, of this city, who is an experienced telephone man and will give the people good service.

HOPKINSVILLE, KY.—Following the election of officers the stockholders of the Christian-Todd Telephone Company, recently chartered with a capital stock of $1,000,000, the announcement was made that the new company would at once take over the systems of both the Cumberland and Home Telephone companies in the counties of Christian and Todd, and operate them as one concern.

MEXICO CITY, MEX.—The Mexican Telephone and Telegraph Company, an American concern with headquarters in this city, has been granted a concession by the city of Guadalajara to install an entirely new telephone system, at a cost of $250,000 in gold, the same to be in operation in about a year and a half. As American capital controls the company, American methods, apparatus and materials will be used as far as possible. The company also plans to connect Vera Cruz, on the east coast, with Manzanilla, on the west, thus giving long distance connection to some of the most important cities of the republic.

LANSING, MICH.—The city council has summoned the heads of the Michigan State Telephone Company to show why their franchise should not be forfeited for inefficient service.

ISHPEMING, MICH.—The stockholders of the Marquette County Telephone Company have authorized the directors to negotiate a deal with the Michigan State Telephone Company for the sale of the company's plant, which includes exchanges at Ishpeming, Negaunee, Marquette, Gwinn, Champion, Republic and Michigamme.

NORFOLK, NEB.—The Independent Telephone Company, operating in Norfolk and vicinity, was recently purchased at sheriff sale by Theodore Parmalee, of Plattsmouth, for $26,000.

OMAHA, NEB.—The Independent Telephone Company was recently sold at receiver's sale to the Nebraska Telephone Company for $995,000. Francis J. Hutchins purchased the franchise for $5,000.

WYMORE, NEB.—At a meeting of the committee appointed to organize an independent telephone company, Dr. S. E. Yoder, chairman, and F. E. Crawford, secretary, were appointed to take charge of stock subscriptions. Pledges of subscriptions from $25,000 to $50,000 will be solicited.

ALBANY, N. Y.—The New York Telephone Company has filed with the Public Service Commission notice of the purchase of the property and business of the Onondaga Independent Telephone Company, for $700,000; the Albany Home Telephone Company, in Green County, for $50,500; the Baldwinsville Telephone Company, for $13,100; the Newburgh Home Telephone Company, for $11,800; the Home Telephone Company, of Frewsburg, for $8,000, and the Deposit Home Telephone Company, for $6,100. The Skaneateles Telephone Company has also been purchased for $20,700.

CLEVELAND, O.—The Cleveland Telephone Company has filed a schedule and an itemized physical valuation of its property, fixing its present worth at $8,070,292, with the State Public Service Commission. Preparatory to a merger with the Cuyahoga Telephone Company contemplates increasing its capital stock from $3,100,000 to $4,000,000, and the commission required an inventory before passing upon this application.

ROCHELLE, TEX.—J. B. Bechtol, of Temple, has purchased the Rochelle Telephone Exchange, formerly owned by Dr. E. P. McGarity, for a consideration of $10,000.